Universidade Europeia
LAUREATE INTERNATIONAL UNIVERSITIES

Master in Management and Business Strategy

Masters Dissertation

THE PERTINENCE AND OPPORTUNITIES OF INCLUDING DESIGN THINKING IN HEALTHCARE COURSES

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Supervisor: prof. Paulo Ferreira, PhD

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Assinatura do autor: 

To my grandmother

Pode ser?
Pau de cera é uma vela,
partida ao meio dá dois cotos!

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"Maybe the knowledge is too great and maybe men are growing too small.
Maybe, kneeling down to atoms, they're becoming atom-sized in their souls.
Maybe a specialist is only a coward afraid to look out his little cage.
And think what any specialist misses…the whole world over his fence."

East of Eden

John Steinbeck

ABSTRACT

Acknowledging the complex nature of health and health-related problems, we propose borrowing human-centred design tools, namely Design Thinking to generate new innovative solutions to tackle them. The present work demonstrates the pertinence of including Design Thinking in healthcare courses, highlighting the method's complementarity to a systemic perspective of reasoning, and its usefulness when answering to the claimed necessity of those courses to broad their scope and focus. Present examples of integration of Design Thinking in health projects; the experts consulted and the analysis of current curricular plans emphasise this pertinence and at the same unveil several opportunities to do so. Our quantitative approach showed no significant difference between healthcare professionals and design students in terms of Empathy, Creativity and other traits considered essential to the process and, thus, confirming the first's aptitude to participate in such projects given the proper coaching.

Keywords – Design Thinking, Complexity, Healthcare, Education

RESUMO

Aceitando a natureza complexa da Saúde e dos problemas que lhe estão associados, propomos a utilização de ferramentas de design centrado na pessoa, nomeadamente o Design Thinking, por forma a gerar soluções inovadoras que possam responder a esses mesmos problemas. O presente trabalho demonstra a pertinência da inclusão do Design Thinking em cursos de saúde, evidenciando a complementaridade que o método pode oferecer a uma necessária perspectiva sistémica, bem como ao essencial alargar da abrangência curricular dos mesmos cursos. Os atuais exemplos de integração de Design Thinking em projetos ligados ao sector, os profissionais consultados e a análise realizada a diversos planos curriculares relevam essa pertinência, bem como as oportunidades para que se verifique de facto. A nossa análise quantitativa não mostrou qualquer diferença estatisticamente significativa entre profissionais de saúde e alunos de design em termos de Empatia, Criatividade ou outras características consideradas essenciais ao processo e, como tal, confirma a aptidão dos primeiros para participar nesses mesmos projetos, verificado o necessário treino.

Palavras-chave – Design Thinking, Complexidade, Cuidados de Saúde, Educação

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APA	American Psychological Association
AUT	Alternatives Use Test
BTK	Berliner Technische Kunsthochschule
CHLN	Centro Hospitalar Lisboa Norte
CQ	Creative Quotient
DT	Design Thinking
ESEnfC	Escola Superior de Enfermagem de Coimbra
FMUL	Faculdade de Medicina da Universidade de Lisboa
FMUP	Faculdade de Medicina da Universidade do Porto
GDP	Gross Domestic Product
HR	Human Resources
IADE	Instituto de Arte, Design e Empresa
NCD	Noncommunicable disease
SPSS	Statistical Package for the Social Sciences
TEQ	Toronto Empathy Questionnaire
UCLA	University of California, Los Angeles
USNCI	United States National Cancer Institute
WHO	World Health Organization

1. INTRODUCTION

Design Thinking is a competitive strategy tool that emerged in the 1990's and that was popularized by companies like IDEO and its founders, and strongly associated with the Stanford d.school.

It embraces the perspective of design as more than an incremental, aesthetical and functional discipline that companies resort to to produce better products or services, but rather, because of its unique ability of understanding peoples' needs, capable of having a more strategic role in organizations.

Design Thinking has a human-centred attitude that through an iterative process tries to reframe problems and find innovative, feasible, viable and desirable solutions.

Because human-centred it relies on Empathy. Because solution focused, iterative, optimistic and failure tolerant, it encourages Creativity.

Nowadays, some modern management courses, aware of the importance of innovation and the imperative of answering to people's needs as competitive advantages, already include Design Thinking in their curricular plans.

Many advocate that this process is suitable for addressing complex broader problems, subsidizing its divergent thinking and human-centred focus to the more orthodox analytical approaches.

In the last couple of centuries, scientific and technological advances gave birth to formidable increments in healthcare. We were able to eradicate some diseases, cure so many others, grant better overall quality of life to our populations and increase their life expectancy.

These accomplishments are inseparable of the scientific method and gradual specialization, which enabled a progressive understanding of the world in general and the human body particularly.

Descartes' Cartesian rationalism relieved science from the burden of religion, appealed to deductive and analytical reasoning as the main source of building knowledge, and set the foundations to which is still now the way we comprehend and construct reality.

One of the main characteristics of this method is reductionism. In an effort to understand the whole, we tend to sum the individual comprehension made of its parts. Aiming at the prediction of outcomes we also tend to find cause and effect relations between different variables. This combination was evidently useful in understanding the human anatomy and physiology, creating processes that enable better clinical approaches.

Despite all the undeniable advances, there are still some complex problems that resist unsolved. Problems with several underlying causes and that result and that are influenced by the interaction of multidimensional components. Because complex, they avoid full comprehension, explanation and approach through the current research paradigm. Problems like climate change, terrorism, social and economic inequities or, in the health domain, child obesity, diabetes, alcoholism or tobacco consumption.

In fact, as addressed in the following chapters, despite the overall improvement of our health, we're still far from achieving the desired results for instance in terms of several chronic diseases and their underlying harmful habits. They're not only strongly related to the main causes of death globally, but constitute also a heavy economic and social burden to society. Because they result from the non-linear interconnected relation of biological, social, environmental and behavioural components, they're much more difficult to tackle.

This complexity encourages a systemic wholeness perspective to address those wicked problems. A perspective that considers every part of the system they constitute and also the relations between them, that is, considering that the whole is more than just the sum of its parts and where Design Thinking may take a significant role.

Nevertheless, the norm in the majority of education organizations is to still rely and encourage an analytical perspective of reality and problems. Medicine and nursing schools are clear examples of that.

Given that the main purpose of the healthcare professionals is the individual and its health, shouldn't their respective courses contemplate subjects that enable a better understanding of people's needs and at the same time deliver new creative solutions to complex problems that so far remain unanswered?

Are healthcare professionals able to participate in multidisciplinary teams that use Design Thinking tools to address those complex problems with Empathy and Creativity?

The present study tries to give answer to those questions.

The literature review will address the origin of Design Thinking, its process, multidisciplinary nature and possible criticism. It will discourse about complexity, the need for a systemic perspective when tackling complex problems and the role of Design Thinking in that process. Finally it will try to classify healthcare as a complex system, give light about the way healthcare complex problems should be considered and why and how Design Thinking could be integrated in the healthcare professionals education.

Afterwards, in a research combined of qualitative and quantitative approaches, it will try to confirm the pertinence of Human-centred subjects in the healthcare professionals' curriculum, its current integration in present curricular plans and, finally, if there are any inapt impediments for healthcare professionals to participate in Design Thinking activities.

2. LITERATURE REVIEW

2.1 Design Thinking

"A purely technocentric view of innovation is less sustainable now than ever, and a management philosophy based only on selecting from existing strategies is likely to be overwhelmed by new developments at home or abroad. What we need are new choices – new products that balance the needs of individuals and of society as a whole; new ideas that tackle the global challenges of health, poverty, and education; new strategies that result in differences that matter and a sense of purpose that engages everyone affected by them." (Brown, 2009, p.3)

2.1.1 Defining Design Thinking

Traditionally, Design was responsible for giving form to tangible objects and, in a business context, for crafting products and brands. Nowadays, though, Design practice extends its range from that product and graphic areas, to the design of digital interactions, the design of service, and even to business strategy and social policy (Brown & Wyatt, 2010; Glen, Suciu & Baughn, 2014; Kolko, 2015).

Design seems to be, in fact, a surprisingly flexible activity and, therefore, it's hard to cover all its diversity of ideas and methods with a single definition (Buchanan, 1992).

Kimbell and Street (2009) recognize Buchanans's "Wicked Problems in Design Thinking" paper as a turning point in design theory, which then shifted from its industrial production origin to a generalized design thinking that could be applied to anything, namely to indeterminate or wicked problems to which designers could provide their unique view and find solutions. This shifted the concept of design from a cognitive style to an intellectual methodology to problem framing and solving.

For Razzouk and Shute (2012) the conceptual design process is not only a moment for synthesising solutions given a specified requirement, but also one where experienced designers come up with their own issues or requirements to assist in solving problems at hand.

The term Design Thinking, though – as intended to be interpreted in this work, and its diffusion are commonly attributed to Tim Brown and David Kelley and their consultancy agency IDEO in close relationship to the Stanford d.school (Brown, 2009; Collins, 2013; Glen et al., 2014; Mugadza, 2015; Sturmberg & Martin, 2013).

For them, Design Thinking is an innovation methodology with a human-centred attitude (Allio, 2014; Brown, 2008). It is a systematic approach to problem solving focused on costumers' needs through an iterative, exploratory process of visualizing, experimenting, creating and prototyping models, and gathering feedback (Glen et al., 2014; Mugadza, 2015).

The solutions are, therefore, generated and progressively refined through that iterative process of providing voice to end-users, which should be engaged in the process (Allio, 2014).

Design Thinking's applicability roots can be traced in business, namely in product design, where understanding people's needs is particularly necessary to facilitate innovation, grant competitive advantage and to achieve strategic and innovation goals (Collins, 2013; Liem & Sanders, 2011; Mugadza, 2015; Sturmberg & Martin, 2013).

But as economies, in modern western countries especially, progressively shift from industrial manufacturing to knowledge work and service delivery, innovation's objectives are no longer just tangible, but also focused on new processes and services, entertainment, and new ways of communicating. These are all human-centred activities and thus Design Thinking's playground (Brown, 2008; Kolko, 2015; Mugadza 2015).

This rise in the importance of human-centred activities smoothens the distinction between business strategy and the design of the user experience, and should therefore refocus the organization on design. Since design is empathetic, it can deliver a more thoughtful human approach to business, humanizing technology and creating emotionally resonant products and services (Kolko, 2015).

Collins (2013) inclusively sees Design Thinking more like a paradigm shift originally proposed as a source of sustainable competitive advantage, than as a linear process or a simple methodology. The author recognises that if its methods are suitable for addressing wicked design problems, then one should assume they could be useful for wicked problems outside the traditional design sphere.

Encouraging creative thinking within the decision-making process enables increasingly effective and efficient solutions. Moreover, Allio (2014) and Kimbell and Street (2009) believe that Design Thinking offers additional value to managers by complementing established analytical techniques.

This perspective considers Design as strategic and disruptive rather than tactical and incremental, and thus, able to address complex problems or contemporary challenges such as

climate change, child obesity or crime prevention (Allio, 2014; Brown, 2008; Glen et al., 2014). As Design moves upstream in the organizations, it enables institutions to better conceptualize and respond to those wicked problems (Boyer, Cook & Steinberg, 2011; Brown, 2008).

2.1.2 The Process of Design Thinking

Generally, the process of Design Thinking includes the fully understanding of the problem at hand, the exploration of a wide range of possible solutions, extensive iteration through prototyping and testing and the implementation of the final solution (Linke, 2017).

When addressing complex problems, one should reject the assumption that defining a problem and then creating a solution is a normative sequence, but rather that those stages should coexist in a continuous feedback loop fed by quick iterations of framing problems and sketching potential solutions (Boyer et al., 2011).

Design Thinking fits that understanding since it is mainly a discipline of prototyping and because iterative, failure tolerant (Kolko, 2015).

As Brown (2009) puts it, innovation could then be understood as a system of overlapping spaces: Inspiration, Ideation and Implementation. In each one, new discoveries can emerge, sometimes inviting the revision of prior assumptions.

It does take in consideration, though, three constrains that should be balanced (see FIG. 1): Feasibility or what is functionally or technically possible; Viability or the likelihood that the innovation will become part of a sustainable business model, and Desirability or what makes sense to people and for the people (Brown, 2009; Matheson et al., 2013). In other words, "Design Thinking – inherently optimistic, constructive, and experimental – addresses the needs of the people who will consume a product or service and the infrastructure that enables it" (Brown & Wyatt, 2010).

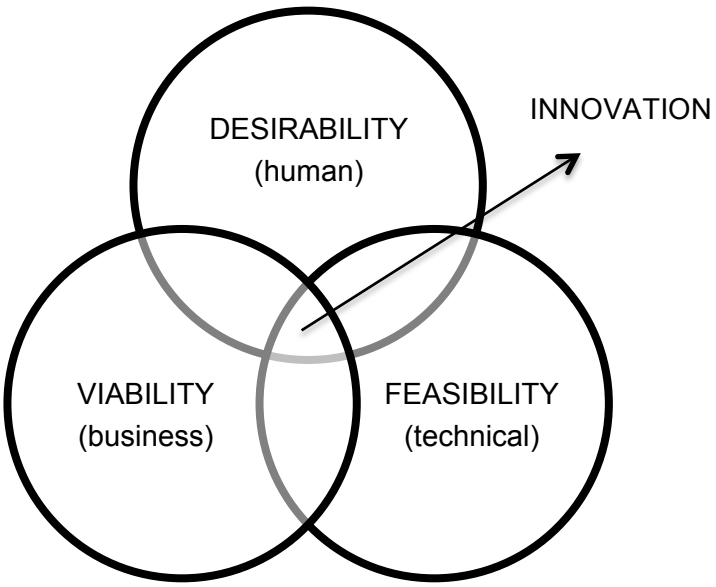

FIG. 1 – Overview of Design Thinking

Source: based on the work of Gasparini, A. (2015). Perspective and use of empathy in design thinking. In *ACHI, The Eight International Conference on Advances in Computer-Human Interactions* (pp. 49-54).

Since it is mainly human-centred, focused on people's needs or in other words constrained by desirability, it praises and identifies Empathy as an imperative (Allio, 2014; Blizzard et al., 2015; Brown, 2009; Cross, 2011; Kolko, 2015; Matheson et al. 2013).

As Brown (2008, p.3) puts it, "by taking a people first approach, design thinkers can imagine solutions that are inherently desirable and meet explicit or latent needs".

Hence, the effort should not be only to recognise what people claim they need, but also what they never dreamed they wanted in order to create solutions that, when offered, people recognise as something they wanted all the time (Cross, 2011).

Empathising may lead to a reconsideration of present beliefs, conventions and values. Empathy feeds the need to understand why things are, which is the foundation of creative work (Allio, 2014).

The need to understand people's latent needs requires more than just asking "what do you need?". It requires the ability to ask the right questions as well as the power of observation to uncover what's not explicit. Design Thinking requires focus on user's emotional experiences and therefore organizations should empower their employees to observe people's behaviour and draw conclusions (Allio, 2014; Blizzard et al., 2015; Brown, 2009; Kolko, 2015).

Since research practise that ignores context is vulnerable to misunderstanding and misrepresentation (Beckman & Barry, 2007), and that inadequate market research is a key factor of failure of innovations (Liem & Sanders, 2011), this pushes the researcher out of the office "to understand the difference between the way things are supposed to work and how they actually work" (Boyer et al., 2011, p.35).

Empathy or empathising should therefore be considered the first step of the Design Thinking strategy (see FIG. 2). More than looking for the right way to address a problem, one should try to understand what's the real problem at hand and frame it correctly (Brown, 2009).

During the process, the work is done going through phases of expansion or input gathering driven by intuition, and phases of contraction or categorization, which are more analytical. To minimize the risk, a balance of intuition and analysis is imperative (Boyer et al., 2011).

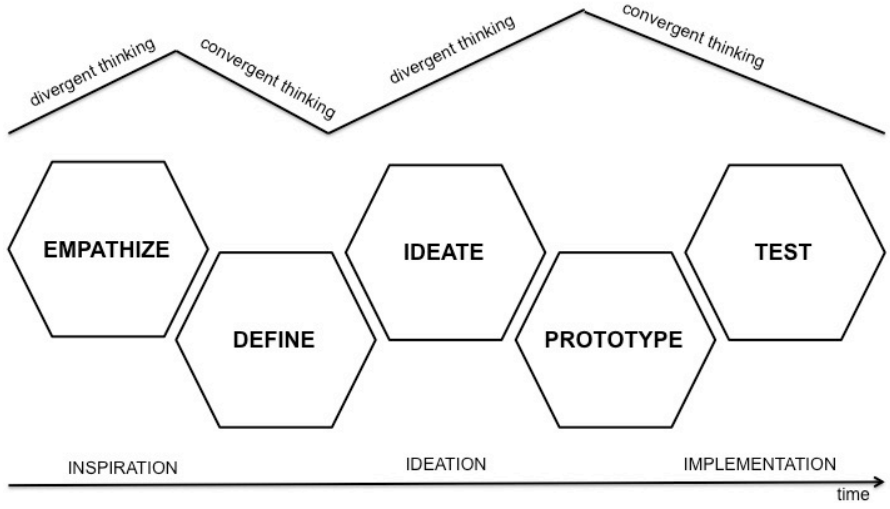

FIG. 2 – Design Thinking process

Source: based on the works of Stanford d.school (n.d). *An Introduction to Design Thinking Process Guide*; Brown (2009). *Design Thinking. HBR 86(6).*

Expansion and Contraction at each iteration cycle are created by the shifting between divergent and convergent thinking. If the convergent thinking is what keeps us on track towards the solution, divergent thinking is responsible for multiplying options and create choices and, therefore, should be understood as the route, not the obstacle, to innovation (Brown, 2009).

Thus, a team should first of all broad its thinking, making it divergent and acknowledging multiple inputs for the problem in an effort to reframe it (Chasanidou, Gasparini & Lee, 2015).

The Ideation phase is where, after framing the problem, the design thinkers generate possible solutions to address it, mainly through brainstorming (Brown 2009; Chasanidou et al., 2015).

For Ogilvie and Liedtka (2011, p.103), "you can't have innovation without new ideas". The authors believe it is through team brainstorming that the diversity of viewpoints and experiences are unleashed and collected, taking the form of collective intelligence. Linke (2017) recommends holding back criticism in this phase, since even infeasible ideas may generate useful solutions.

Prototyping picks up on the ideas generated, and in a convergent effort, tries to rapidly unite and make tangible the best of all of them, while determining which solutions are technological possible (Brown, 2009; Chesanidou et al., 2015).

Finally, testing or the implementation phase allows the understanding of the effectiveness of the solution created taking it into people's lives, and by that evaluation, the need to iterate and refine and from where in the process it should be revisited (Allio, 2014; Brown & Wyatt, 2010).

For Linke (2017) the skills associated with these steps, namely empathy and the creative teamwork, can be readily learned, but take effort.

2.1.3 Design Thinking as multidisciplinary

The increasing complexity of products, services and experiences, shifts the idea of what a designer should be, from a lone creative genius, to an enthusiastic interdisciplinary collaborator instead. Collaboration becomes essential to make a better understanding of what are the problems at hand, and at the same time create more and better solutions (Brown, 2008; Brown, 2009).

Design Thinking is necessarily a team effort and those teams should be multidisciplinary and balanced in terms of age, gender, and domain of expertise of their constituents (Allio 2014; Boyer et al., 2011).

In fact, design thinkers aren't necessarily an exclusive product of design schools. For Brown (2008), many people outside professional design show a natural aptitude to design thinking that can be unlocked and enhanced given the right training, development and experiences.

For Boyer et al. (2011) it's irrelevant for the process if one is the top expert on a subject if he is unable to relate to others and deliver his ideas in a open, productive manner. Thus, Design

Thinking requires experts on their field, but also people curious about the world and able to accept models that conflict or even contradict their own.

Moreover, Brown (2008) doesn't encourage interdisciplinary collaboration alone, but he believes team members should have themselves experience in more than one field (e.g. engineers/marketers, anthropologists/industrial designers or architects/psychologists).

For Chasanidou et al. (2015), multidisciplinary teams and the adoption of multiple design perspectives are expected to increase the performance in terms of quality of decision-making or the innovativeness of problem solving.

2.1.4 Criticism to Design Thinking

Some claim that Design Thinking might become a meaningless fashionable term without true business value (Pourdehnad, Wexler & Wilson, 2012).

In fact, it's many times only a buzzword picked up by the market to generally characterise the skills needed to create strategic intent, a method for companies to seek better input from the market or even only a transversal soft skill everyone should have (Boyer et al., 2011).

Collins (2013) argues that if Design Thinking is many times reduced by companies to a more linear process, maybe that is a consequence of their struggle with the messiness and risk-taking necessary to adopt it.

For the same author, in an attempt to seek a tidier proposition with lower risk, business tries to replicate Design Thinking in a simple process or methodology, rather than assume it as the paradigm shift it should be (Collins, 2013).

The truth is, though, that Design Thinking has been applied in developing new products as well as services in a broad range of problems from selling solar panels in Africa to the operation of Airbnb, and seems to be useful to any problem that needs a creative solution (Linke, 2017).

2.2 Wicked Problems

"The difficulty of knowing our world is aggravated by our mode of thought which has atrophied instead of developing the aptitude to contextualize and globalize, whereas in this planetary era we must conceive its globality, the whole-part relation, the multidimensionality, the complexity" (Morin, 1999, p.31).

2.2.1 Complexity

As Castells (2011) puts it, these are confusing times since we're going through a transition between different forms of society and "the greatest constant of modern times is change" (Sterman, 2000, p.3).

Social, technological, economic, and cultural transformations gave form to a new network society and, thus, to an increased rate of change, complexity and uncertainty (Castells, 2011; Kolko, 2015; Pourdehnad et al., 2012).

For Sterman (2000), moreover, while the complexity of systems we live in grows, we frequently now realise that the policies we implement to solve the emergent problems fail and might even create new problems.

Descartes' Reductionism has had a profound influence in the way we understand the world, and was the base to many scientific breakthroughs that improved life and knowledge for the last centuries (Boyer et al., 2011; Heng, 2008; Pourdehnad et al., 2012).

Cartesianism gave birth to reason, empiricism and the scientific method, and became our paradigm of understanding. As Descartes separated mind and body, we came to believe that everything could be understood by reducing it to its individual parts – like a clock. Observation and experimentation seek explanation by cause and effect, and thus, determinism. Problems are, therefore, considered in isolation through an increasingly narrowing process (Boyer et al., 2011; Heng, 2008; Morin, 1999; Pourdehnad, et al., 2012).

We've encouraged specialization assuming that silos of knowledge were necessary to understand the whole. Although that yielded great advances, by understanding knowledge as a group of isolated dots or silos, the big picture will be biased by the gaps between them (Boyer et al., 2011; Heng, 2008) (see FIG. 3).

FIG. 3 – Silos of Knowledge

Source: Roy Lichtenstein's "Ohhh... Alright..."; retrieved from https://media.npr.org/assets/img/2012/10/12/3287-129_wide-71585657ee66b0df263689bd5e1843094a3d34c3.jpg?s=1400
Based on the original idea of Boyer et al. (2011). *In Studio: Recipes for Systemic Change: Helsinki Design Lab*. Sitra.

According to Morin (1999), this compartmentalized learning process is inadequate to grasp realities and problems progressively global, multidimensional, transversal and planetary.

Complex Systems in which the interaction among its own constituents and the system and its environment are of such nature, that the whole can't be fully understood by simply analysing its components (Cilliers, 1998).

In other words, complex systems that are built over an interconnected tissue of functionally related components, and where those interconnections are non-linear (Mugadza, 2015; Pourdehnad et al., 2012).

Orthodox forms of problem framing, planning and evaluation frequently ignore or exclude that dynamic complexity feature (Leischow & Milstein, 2006).

Knowledge based on isolated data is not enough, since gaps between silos often prevent us to connect parts and wholes. For that reason, information and data must be placed in their context (Morin, 1999). After all, as the Islamic scholar Jalal ad-Din Muhammad Rumi once claimed, "You think because you understand ONE you must also understand TWO, because one and one makes two. But you must also understand AND".

This is particularly critical when the problems or systems at hand involve human behaviour. Take climate change or child obesity as examples. Understanding the nature and dynamics of those systems, demands the understanding of people and their interactions (Leischow & Milstein, 2006). Ultimately "I am myself and my circumstance" (Gasset, 2000, p.13).

At the same time, companies, as they seek more and more to provide complete solutions than simply products, are also struggling with increasingly broad complex challenges (Beckman & Barry, 2007).

Thus, nowadays, the challenge lies in developing new ways of tackling problems and creating ways to work across silos (Boyer et al. 2011).

2.2.2 Systems Thinking

Systems Thinking pursues just that: the development of methods to tackle those wicked problems (Mugadza, 2015).

It emerged in the 1950s, precisely as a response to reductionism and scientific method's incapacity to answer to the complexity inherent in biological and social domains (Jackson, 2003).

Committed with the concept of systemic wholeness, in which reality should be understood as more than the sum of its parts, it replaces reductionism with expansionism. One should seek the role of the system in the larger system of which it is a part of, rather than gaining isolated knowledge by understanding its own parts (Pourdehnad et al., 2012).

It is a transdicipline since it draws ideas and concepts from a variety of different disciplines allowing it to draw their different strengths in a joined-up thinking to better address complex issues (Jackson, 2003). It creates its own epistemology by linking different silos of knowledge with profound implications for how new knowledge is gathered, synthetised, interpreted and disseminated (Leischow et al., 2008).

In fact, for Leischow and Milstein (2006, p.403), Systems Thinking is, rather than a discipline, "a paradigm or perspective that considers connections among different components, plans for the implications of their interaction, and requires transdisciplinary thinking". For Sterman (2000, p.4), "it is a method to enhance learning in complex systems".

Applied to the health context, for De Savigny and Adam (2009, p.19) "Systems Thinking has a huge and untapped potential in deciphering the complexity of an entire health system and then in applying this understanding to design and evaluate interventions that improve health and health equity".

2.2.3 Systems Thinking & Design Thinking

For Mugadza (2015) the concepts of Systems Thinking and Design Thinking aren't mutually exclusive at all. They complement each other. As for Pourdehnad et al. (2012), they claim that Systems Thinking should be integrated by Design Thinking to improve the chances of creating the right design, as it brings the need to consider the whole system to the discussion, not just the parts.

Systems Thinking is focused, from a systemic world view, on framing and thereafter solve complex problems (Mugadza, 2015). It's, as Boyer et al. (2011) affirm, all about asking the right question. As said before, traditionally, design thinking was set on approaching problems in a variety of different perspectives emphasising on the solution. Once it became strategic – as Brown, IDEO and the d.school conceptualized it, and entered the management/strategic domain, it was faced by complex problems (Brown, 2008). Design thinkers understood the need to become systemic and also focused on problem framing and could, therefore, benefit from the Systems Thinking philosophy (Mugadza, 2015).

If Design Thinking recognises now as an imperative, the correct definition of a starting point or problem framing (Allio, 2014; Beckman & Barry, 2007) it's fair to say it should consider the Systems Thinking holistic perspective to achieve just that. "The more we can think systemically rather than in institutional and disciplinary silos, the more likely it is that we will achieve results" (Boyer et al., 2011, p.16).

On the other hand, "Design Thinking can add an interesting value added when tackling wicked problems, where Systems Thinking alone may be significantly handicapped" (Szulansky, 2010, p.3). Namely by adding its ability, sensibility and practise in the solution domain, as well as its iterative nature, which can help achieve the recalibration that complex environments impose (Allio, 2014; Mugadza, 2015; Szulansky, 2010).

As Vechakul, Shrimali and Sandhu (2015, p.2553) claim, "human-centred design provides a framework for moving quickly towards action while retaining a systems perspective".

For Pourdehnad et al. (2012), when faced with new data that doesn't fit a currently understood model, one must first wonder instead of observe. That is, creatively think about what can be done with the data like an exercise of abductive reasoning, before a more analytic reasoning takes over. That's when Design Thinking emerges. Not to declare a conclusion to be true or false, but to suggest what could possibly be true.

It provides a third way, nor intuitive, nor analytical, to the design process and decision-making (Brown & Wyatt, 2010). The balance mentioned before (see section 2.1.2).

Finally, because Systems Thinking' tools should be applied to the behaviour of human as well as physical and technical systems (Sterman, 2000), and since addressing complex systems involving human behaviour demands the understanding of human complexity, Morin (1999) argues that for that understanding, empathy is indispensable. That might just well suggest another bridge to Design Thinking and its human-centred heuristics (Pourdehnad et al., 2012).

2.3 The wicked problem of Healthcare

"While it is easy to agree that the focus should always be on delivering better health, it can also be difficult to remember that the systems we live with, such as healthcare, are human constructions and their dynamics are the result of accumulated decisions. They can be redesigned. Doing so, many entail a critical re-examination of the notion of best practise to ascertain whether established wisdom is still wise in our current context" (Boyer et al., 2011, p.27).

2.3.1 Healthcare as a Complex System

For Wilson, Holt and Greenhalgh (2001), illness and human behaviour, because they're part of biological and social systems that are inherently complex, are impossible to predict or be accurately modelled in a simple cause and effect system.

Although the human body is far from being a machine in which its parts can be broken apart and analysed in isolation, the truth is that that cause and effect model supports much of what it still is the clinical practise. The available analytical techniques made us break the system into smaller bits, study those bits, reassemble them back together, and draw conclusions. That may well be the reason we often fail, why we see little change in care quality despite the substantial quality improvement efforts, and why the current reductionist and determinist clinical level of knowledge and approach may not be the best starting point to further advances in healthcare (Anderson, Crabtree, Steele & MacDaniel Jr, 2005; Matheson et al., 2013; Wilson et al., 2001).

Current health reform discussions are mainly focused on developing healthcare that is more efficient, available, and with improved quality, but it seems to neglect how it is being taught and practised. Modern medicine tends to neglect a comprehensive model of health, treating disease in isolation, and not taking into account the dynamic, integrative system of the human body (Federoff & Gostin, 2009).

For Cilliers (1998), the analytical method, in its effort to "cut up" a system, destroys what it seeks to understand. Heng (2008) believes that the key obstacle to future medicine is precisely that conflict between the reality of complexity and its ruling reductionist approach.

In fact, as the other complex systems, healthcare organisations are complex adaptive systems in which relationships are, for that reason, generally nonlinear (Anderson et al., 2005), and the concept of public health should be based on the premise that health and illness have

causes or conditions that go beyond the biology and behaviour of the individual (Midgley, 2006).

Chronic diseases, in particular, should be considered complex systems where "behaviours mutually influence one another to manifest problems that differ from context to context" (Sturmberg & Martin, 2013, p. 582).

Following that line of thought, traditionally, physicians are taught that the individual patient has priority. That seems to be the normal practise whether in a treatment or in a preventive perspective in which the focus is reoriented towards detection and modification of individual risks (Marmot, 2001). As Rose (1985) puts it, though, case centred epidemiology identifies individual susceptibility, but it may fail in identifying the underlying causes of incidence, since the primary determinants of disease are economical and social.

After all, there are geographical, social, ethnic and gender differences in rates of disease occurrence (Marmot, 2001).

At the same time Yildirim and Ozkahraman (2011) observe that critical thinking or the complex, multidimensional, cognitive process that depends on reflective thought and acceptance of ambiguity is essential for decision-making in nursing practise. It's about gathering and analysing information and using it as a guide to answer unpredictable client circumstances by adding creativity and taking risks. Although it has been important to nursing practise for a long time, the authors recognize that by being equated with the essentially analytical Nursing Process, critical thinking is often narrowed to a linear problem solving exercise.

That seems to contradict the complexity perspective that defends the use of the health care providers' intuition and personal experience, when general scientific rules are to be applied to the individual context, and that clinical decision-making should have a holistic perspective, accept unpredictability, and understand the context in which health care is being delivered, (Wilson et al., 2001).

Leischow and Milstein (2006) believe that is time for public health workers to adopt systems thinking and modelling and point out that considerable investments are already being made to consider systemically complex problems such as foodborne illnesses and the long-term implication of childhood obesity. For the authors, this perspective should help anticipate future threats and, at the same time, save money and lives.

This systems medicine holistic approach to medical education and practise, which considers the complex biochemical, physiological and environmental interactions of the living being, should benefit patients and society (Federoff & Gostin, 2009).

2.3.2 Some epidemiologic facts & numbers

In this section will go through some facts and numbers, namely those related to the prevalence and burden of non-communicable diseases (NCDs), which in our opinion give evidence of the complexity of healthcare and the still inadequate answer of the traditional approaches.

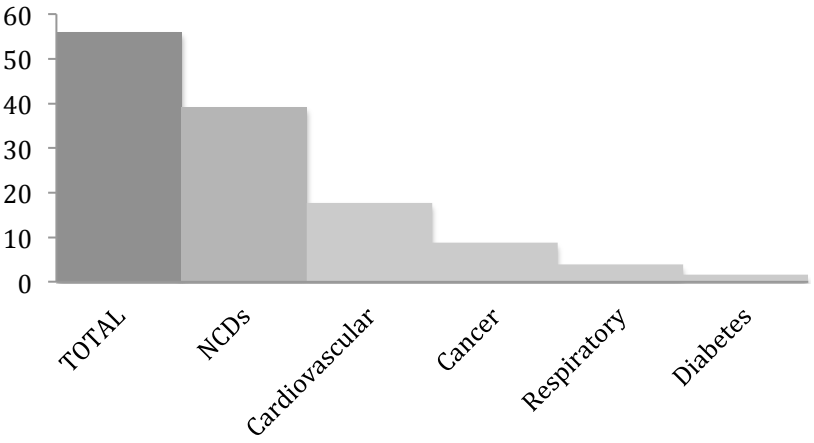

FIG. 4 – Global mortality and NCDs (Million deaths)

Source: based on the work of WHO (2017). *World Health Statistics: Monitoring Health for the Sustainable Development Goals*

The World Health Organization (WHO) (2017) estimates that in 2015, 70% of all worldwide deaths occurred due to NCDs, the most relevant: cardiovascular disease, cancer, chronic respiratory disease, and diabetes (see FIG 4).

The same report states that the risk of dying from one of the main NCDs decreased from 2000 to 2015, mainly at the expense of a rapid decline of cardiovascular mortality. The mortality rates of the remaining three have fallen for the last 15 years at a very slow pace (WHO, 2017).

But not only mortality, but also morbidity from preventable NCDs threatens the population health, and world economies. NCDs incidence impacts productivity and boosts healthcare

expenses and, to make matters worse, the number of people affected by these diseases is expected to rise in the coming decades (Bloom et al., 2012; Matheson et al., 2013).

In 2012 it was estimated that the big four NCDs, along with the chronic mental health diseases, would be responsible for a US$ 47 trillion cumulative cost over the following two decades. That's 75% of the global 2010' GDP (Bloom et al., 2012).

Those leading diseases share key risk factors related to lifestyle: tobacco use, unhealthy diets, lack of physical activity, and alcohol use and are, for that matter, largely preventable (Matheson et al., 2013; WHO, 2014a; Yach, Hawkes, Gould & Hofman, 2004).

In 2016, the average worldwide consumption of alcohol (translated to pure alcohol) was 6,4L per person (aged 15 or more) (WHO, 2017a), and in 2012, approximately 3,3 million deaths were related with alcohol consumption (WHO, 2014).

The WHO's report (2014) states that the most prevalent tendency worldwide is an increase in recorded per capita consumption (see FIG. 5), and makes reference to several studies that estimate the social and economic costs of alcohol consumption: €125 billion in 2003 in the EU; £21 billion in 2009 in the UK, and US$ 233,5 billion in 2006 in the USA.

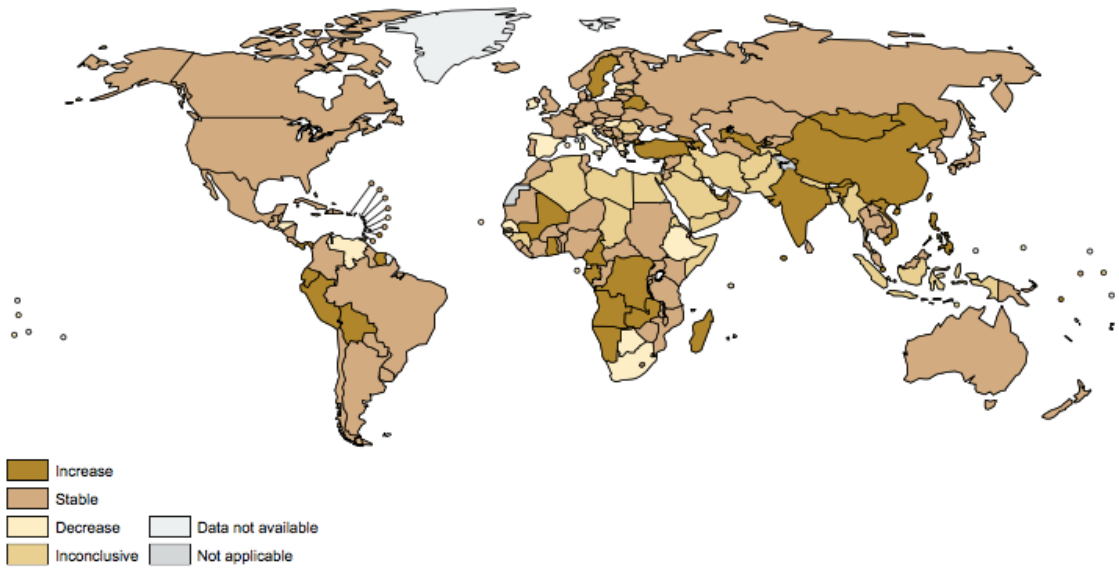

FIG. 5 – Recorded alcohol consumption per capita (15+ years) evolution, 2006-2010

Source: WHO. (2014). *Global status report on alcohol and health 2014*.

It also states that the evidence shows that the most effective measures on alcohol consumption are taxation, availability restriction, and bans on advertising.

According to the WHO (2015), in 2013, 1,1 billion adults worldwide were active smokers. Yet, the prevalence declined from 23% of the global adult population in 2007, to 21% by then (see FIG. 6).

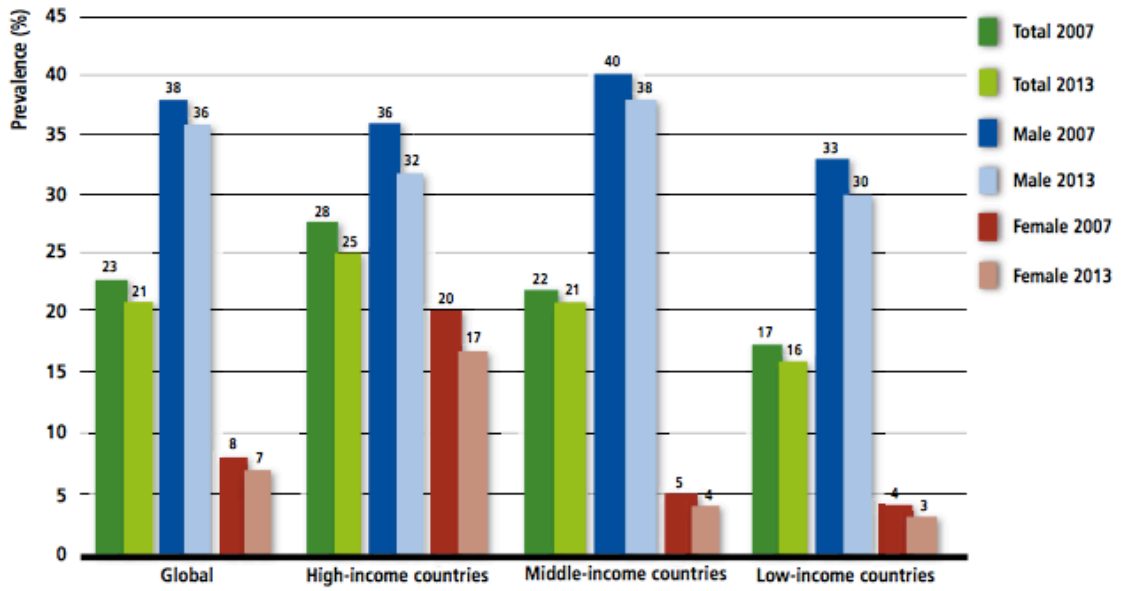

FIG. 6 – Adult tobacco smoking prevalence (2007 & 2013)

Source: WHO. (2015). *WHO report on the global tobacco epidemic, 2015: Raising taxes on tobacco.*

Although in most world regions and income groups, the prevalence of tobacco use is constant or falling, globally, approximately 6 million people still die from diseases caused by tobacco use. 10% of those from second-hand smoke exposure. In fact, if in many countries, there's been a considerable decrease in smoking prevalence, in many others there's been little or even the opposite. Moreover, it is expected that by 2030 the smoking related deaths will increase to 8 million and, hardly, the global target of 30% reduction set by the WHO State Members will be met (Islami, Torre & Jemal, 2015; U.S.NCI & WHO, 2016).

Several organizations fact that the most effective measures for tobacco demand reduction are significant tax and price increases; bans on marketing activities, and the pictorial health warning labels on packages. However, they also highlight that the majority of the world population is still not covered by those interventions (U.S.NCI & WHO, 2016; WHO, 2015;).

As for diabetes, both the number of cases and the prevalence of the disease have been steadily increasing over the past few decades. In 2014, it was estimated that 422 million

adults had diabetes, against 108 million in 1980. That's a global prevalence increase from 4,7% to 8,5% in the adult population (WHO, 2016) (see FIG. 7).

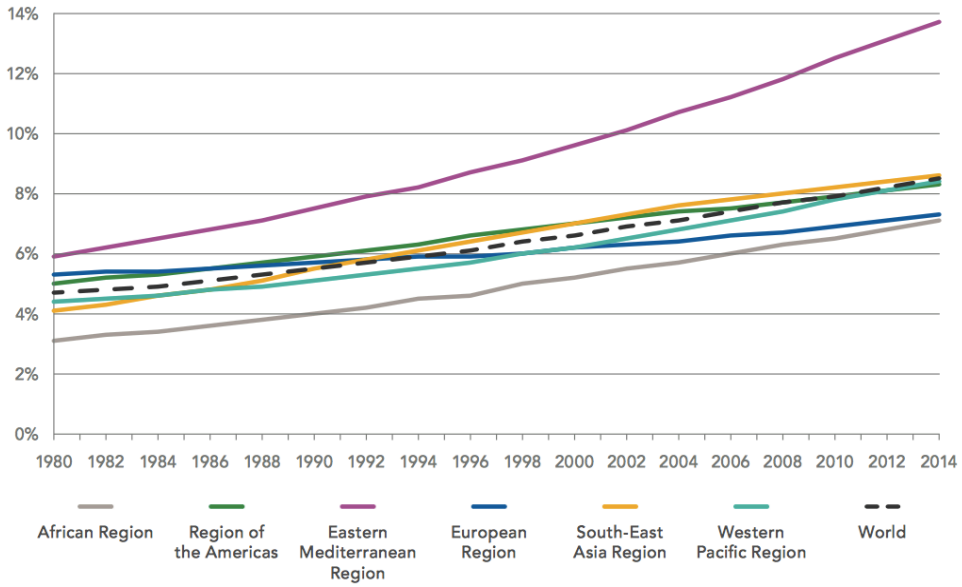

FIG. 7 – Trends in prevalence of Diabetes, 1980-2014, by region

Source: WHO. (2016). *Global report on diabetes.*

Bommer et al. (2017) estimated that in 2015 the total global cost of diabetes was US$ 31trillion, or 1,8% of the global GDP. The authors recognized the fact as a global economic burden that is transversal from high-income to poorer world regions.

The WHO diabetes report (2016) associates this increase with population growth and ageing, but also with overweight and obesity prevalence, and thus, emphasises the need to prioritise actions to prevent them as early as before birth and early childhood. It stresses the need of a coordinated multicomponent intervention of all stakeholders, and it also recommends addressing key gaps in the diabetes knowledge base, as well as the evaluation of innovative programmes intended to change behaviour.

Obesity, which increases the likelihood of diabetes, hypertension, coronary heart disease, stroke and certain kinds of cancer, has seen its prevalence nearly doubled worldwide since the 80's. In 2013, 11% of adult men and 15% of women were obese, and more than 42 million children under 5 were overweight (WHO, 2014a).

Overweight and obesity affects all social, cultural and economic groups in every corner of the world and in 2010 it was responsible for 2,8 million annual deaths (Roberto et al., 20).

This epidemic is considered to have the potential to negate many of the healthcare benefits that have been contributing for the increase of lifetime expectancy. It is especially worrying among children, and it's believed to be the result of changes in food availability and type and, at the same time, of a decline in physical activity (WHO, 2016a).

2.3.3 Fighting the numbers & the role of Design Thinking

It is evident the considerable progress made over the past decades in understanding the causes of NCDs, and in developing insight for strategies to prevent, detect and control them (Remington & Brownson, 2011).

Despite these improvements, several authors and organisations defend that the global response to the problem is still inadequate (Matheson et al., 2013; Remington & Brownson, 2011; WHO, 2014; WHO, 2014a; WHO, 2016; WHO, 2017; Yach et al., 2004).

When addressing the underlying problems in healthcare, the focus seems to be developing feasible, rather than also desirable solutions to those problems, and that can explain why decades of tool development hasn't achieved the expected results in terms of prevention (Matheson et al., 2013).

Anderson and McDaniel Jr (2000) suggest a shift on health care managers' perspective with the purpose of creating innovative strategies for the management of healthcare organisations, while the WHO (2015a) recommends reinforcing and reorienting health systems to address the prevention and control of NCDs and their underlying social determinants through people-centred primary health care.

Remington and Brownson (2011) encourage further epidemiologic research not only to elucidate the causes of disease, namely the influence of genetic, behavioural, social, economic, and environmental exposures, but also to identify how those dimensions impact health behaviours like exercise and diets. Furthermore, they defend the need to finance programs that accelerate transformation of research into practise, and the shift in funding incentives from paying for more care to paying for good health.

Matheson et al. (2013) claim that the complex non-linearity of health behaviour is particularly determinant when addressing prevention and complex chronic diseases. Since prevention is aimed at the absence of a future health problems and, because those problems often result from ingrained habits or human behaviour, empathic, desirable solutions become

critically important. Moreover when, despite being common sense to every layperson the importance of a healthy lifestyle, compliance to guidelines is poor and inconsistent.

Ariely (2008) contradicts the notion that we, as individuals, are economically rational. Rather, the author defends that, given specific circumstances, we quite often fail to weight costs and benefits and to make the most logical economical decisions.

Couldn't it be that the same happens in the realm of health?

In fact, research led by Sharot, Riccardi, Raio and Phelps (2007), suggest that humans are inherently optimistic when regarding their future, and that there is a neurologic reason for that bias. In their studies, healthy individuals overestimated the occurrence of positive events, (e.g. the expectation to live longer and healthier), and underestimated the risks of negative episodes.

That can only add up to the complexity of understanding and guiding human behaviour, which for Matheson et al. (2013) is moulded by an overlapping correlation of individual, interpersonal, environmental and policy factors. For that reason, the authors claim that current strategies of chronic disease prevention and management may need to be merged with human-centred design.

Design Thinking's multidisciplinary problem-solving approach could be helpful in creating innovative creative solutions by inspiring new ways to frame the public health problems, when balanced with the evidence of big data, and the feasible opportunities of technology (Matheson et al., 2013; Schwartz 2016; Sturmberg & Martin, 2013).

Because it's every health care leader's mission to improve patient experiences, Design Thinking may be a useful resource for achieving just that by offering empathy towards patients, creative thinking, prototyping and continuous testing of solution to health related problems (Sharon, Myers & Allen, 2017).

For Allio (2014), the prototyping iterative nature of Design Thinking could prove to be very powerful. Prototypes should be seen as vehicles of change. They allow the suggestion of an idea without the specification of every detail, and also the subsequent refinement through their launch and testing.

The best way to institutionalise prototyping and creative experimentation and, at the same time, overcome the *status quo* resistance, is through the implementation of small-scale and local projects. Projects allow the iterative approach necessary to prove Design Thinking

legitimate. Being limited in terms of scope, time and budget, they are small enough to be grasped, but big enough to deliver impacts, prove effectiveness and create momentum (Allio, 2014; Boyer et al., 2011).

Human-centred design principles are already being practised in the healthcare domain, although many times, because some of those principles are intuitive or overlapped with other practises, not necessarily called by that name (Vechakul et al., 2015).

The works of Allio (2014), Brown and Wyatt (2010), Searl, Borgi and Chemali (2010), among others, give examples of the integration of Design Thinking by design firms, healthcare organisations and start-ups, as a tool to develop innovations in medical devises, patient experiences, and healthcare systems.

For Kalaichandran (2017) health providers are good problem solvers and because they work in different healthcare settings, they're uniquely positioned to come up with innovative solutions to healthcare problems.

The most striking example of the integration of Design Thinking in healthcare we came across is the Helix Centre. The Helix is a multidisciplinary team, which motto is *we believe health and healthcare can be better with design.* It's a joint collaboration between the Imperial College of London and the Royal College of Art set in St Mary's Hospital in London. They address real healthcare problems making use of several design methods to dissect them, envisage opportunities and prototype solutions. At the same time, they're focused on educating leaders and teams in the practise of human-centred design in healthcare (Helix Centre, n.d.).

Nevertheless, Vechakul et al. (2015) defend that, even if commonly practised in the healthcare domain, in public health specifically, that may not be the reality.

In fact, Sharon et al. (2017) consider that Design Thinking is still underused and defend that if more leaders embrace it, they would gain considerable understanding of patients in order to solve complex problems, achieve better clinical outcomes, improve patient experience and lower costs at the same time.

2.3.4 Integrating Design Thinking in Healthcare professionals' education

This era characterised by a challenging emergent landscape is the source of new pressures and opportunities to which the present education systems doesn't seem to be adapted to.

More than just the understanding of being part of a community or nation, students should realise their responsibilities as global citizens (Boyer et al., 2011).

At the same time, some physicians see medical training as a century-old model with heavy focus on memorization (Bach, 2016).

In fact, currently, most traditional academic environments encourage students to read critically, think and reason logically, and at the same time, to solve complex problems (Razzouk & Shute, 2012).

For Beghetto (2017), uncertainty is most of the time replaced in the classroom context by overplanned learning experiences and clearly defined, consistent and controlled problems that students should solve, hence learning from routine. The author claims that is precisely uncertainty what makes a problem a problem, and that in order to prepare students to respond to it prolifically, they should be engaged in a full range of challenges, namely those that are ill-defined.

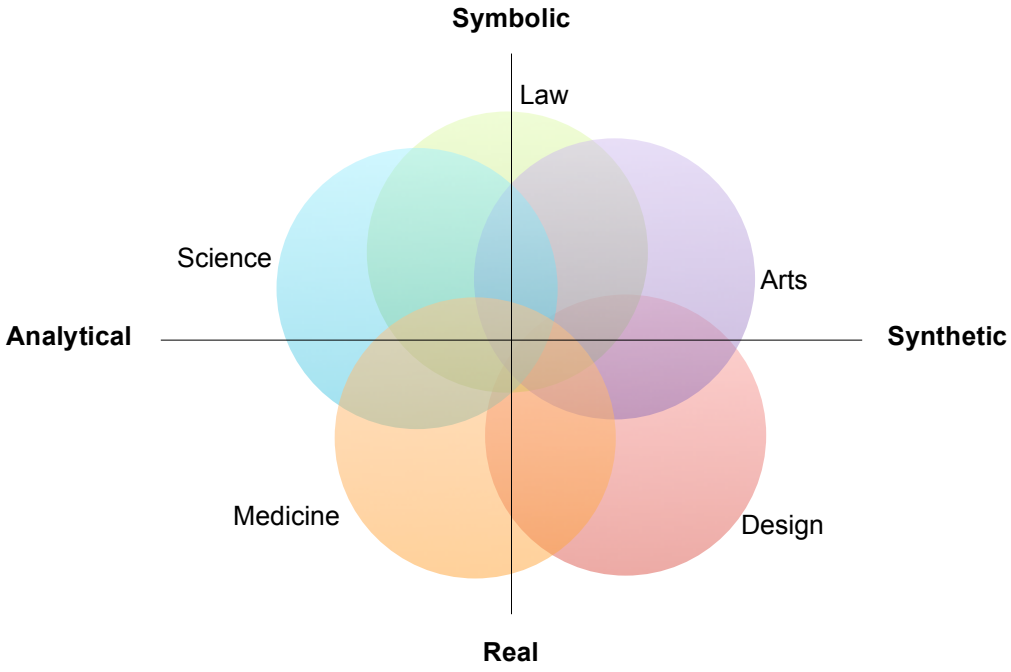

FIG. 8 – Processes of thinking: differences between fields

Source: Adapted from the work of Owen, C. (2007). Design thinking: Notes on its nature and use. *Design Research Quarterly*, *2*(1), 16-27.

Considering the fundamental differences in processes of thinking and working between different professional fields, Owen (2007) suggests a conceptual map (see FIG. 8) with two

axes (symbolic/real and analytical/synthetic) that characterises them according to content and process factors.

If the left quadrants of the map are more centred in discovering, the right ones are more focused on inventing; if the upper fields are more concerned with the abstract or the tools and rules that enable communication and interaction, the lower ones are concerned with the tools and systems necessary to physically manage the environment (Owen, 2007).

This model suggests an almost perfect complementarity between Science and Design. The first one devoted to symbolic measures of Correctness, the latter with more physical Effectiveness, that is, what is True/False and which are the multiple solutions that can be equally and tangibly successful. Hence, a combination of Science and Design as a source of advice is better than either alone.

As for Medicine, it is strongly concerned with the real problems of human health, and since diagnostic processes are its main focus, heavily analytical. Thus, it should construct itself feeding on the discoveries of science, but also on the effective solutions suggested by Design.

Because Design Thinking pushes their teams outside, encourages relationships with different stakeholders and demands empathy, all in the pursuit of effectively framing the problems at hand, it may be in some cases, such as in complex situations, more successful than science alone in doing so (Boyer et al., 2011; Brown, 2009; Glen et al., 2014).

In other words, Design Thinking, through its ability to manage complexity, may offer a bridge between systems science and health promotion (Sturmberg & Martin, 2013).

For Glen et al. (2014), given the present context, we should develop new pedagogies that combine the analytical reasoning with the more exploratory skills traditionally held by designers.

A panel of physicians set in integrating Design Thinking in medical school training (Bach, 2016) discussed the advantages of doing so. Design Thinking was, for them, a way to prepare students for a career characterised by change. They saw design beyond its ability to create bright shining objects. They reckon it more as a tool to tolerate ambiguity and tension, and avoid falling into the obvious solution too fast.

Design Thinking may therefore have a positive influence on future education. Helping students across disciplines in developing skills such as Design Thinking, Systems Thinking, teamwork, and creativity would enhance their problem solving aptitude (Razzouk & Shute, 2012).

It may also mitigate what Runco (2004) considers the potential costs of creativity. The author points out that commonly the profile of ideal student emphasises conventional rather than creative behaviour. He understands that there is a stigma attached to creativity, once it is strongly attached to originality. Because original behaviour is contrary to norms, all creativity is a kind of deviance.

Additionally, Design Thinking projects involving interdisciplinary student teams, can function as a practice field for cross-functional interactions in future work situations. A human-centred perspective could, furthermore, emphasise the connection between the problem-solving process proposed to students, to those who will be affected by their decisions (Glen et al., 2014).

Despite all that, because teaching Design Thinking is one thing when the final purpose is the industry or consulting markets, and another is the institutional or governmental planning, Brown (2008) advocates the need to create new kinds of design programs.

3. RESEARCH MODEL

The main objective of this study was to understand the relevance of including strategic design subjects, namely Design Thinking, in the healthcare courses. With that in mind, as explained in the following chapters, considering the insights that rose from the literature review, we proposed our hypotheses and subsequent research questions, and, taking the Portuguese reality as example, undertook three parallel approaches to confirm them.

3.1 Research Theory

We were driven by the deductive reasoning theory that, for Bryman and Bell (2015), is the process by which the researcher "on the basis of what is known about in a particular domain and of theoretical considerations in relation to that domain, deduces a hypothesis that must then be subjected to empirical scrutiny" (p. 24).

Bottom-line, attempting to make a bridge to what emerged from the literature review, consubstantiated in the claim that healthcare would benefit from the inclusion of Design Thinking given the complex problems that faces, we tried to understand what opportunities were presently offered, in order to sustain that inclusion. Those opportunities were meant to be acknowledged comprehending the understanding of two experts on the matter; realising the present involvement of design thinking in healthcare courses, and by testing the healthcare professionals' aptitude to take part in multidisciplinary teams to address complex problems through a human-centred perspective.

Summing up, the present work pretended to answer the overarch question: **Is it pertinent to include human-centred subjects in healthcare professionals' education?**

This overarch question was the starting point for the definition of the following hypotheses.

3.1.1 Hypotheses

The general hypothesis that guided this research could be translated as:

H: It's relevant to include human-centred subjects in healthcare professionals' education

This hypothesis can, in turn, be ramified in the following hypotheses:

H1: The present healthcare curriculums don't include strategic design subjects

H2: There's no difference between healthcare professionals and design students in terms of Empathy

H3: There's no difference between healthcare professionals and design students in terms of Divergent Thinking

H4: There's no difference between healthcare professionals and design students in terms of any other significant Design Thinking traits

4. METHODOLOGY

Given the hypotheses presented, the current chapter describes the subsequent research strategy, design, methods and tools chosen to confirm them.

4.1 Research Strategy

Assumed the deductive approach of the study, to confirm our hypotheses, we emphasised in the collection and analysis of data, which configures a quantitative research (Bryman & Bell,

2015). This data emerged from the analysis of the current curricular plans of healthcare education institutions, and from questionnaires applied to healthcare professionals and design students. Although primarily quantitative, the unstructured interviews that were made to Prof. Rui Tato Marinho, Md and PhD, and to Daniel Santos, designer, gave a qualitative complement to the study that along with the literature review insights, served as foundations to build our hypotheses, and to assist in the discussion of the quantitative outputs.

4.2 Research Design

A great deal of what was the testing of our hypotheses came from the analysis of the questionnaires. They provided a set of data, which enabled the connection with more than two variables, as we tried to identify and measure the differences between healthcare providers and individuals with a design background in the characteristics that were acknowledged in the literature review chapter as the most essential to the Design Thinking. As so, for Bryman & Bell (2015), that constitutes a cross-sectional research design.

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4.3 Research Sample

The curricular plans analysed, the subjects interviewed, and the questionnaire respondents were all sampled with a non-probability method. We chose to analyse three Medicine and three Nursing schools' courses, one of each sited in one of the main health centres of the country – Lisbon, Porto and Coimbra.

The interview and questionnaire respondents were chosen according to their availability to the researcher. They are, for that reason, convenience samples.

For the questionnaire in particular, we tried to form two main clusters each represented with other sub-clusters as the table represents (see Table 1).

Table 1

Questionnaire sample.

Cluster	n	Sub-cluster	n
Healthcare professionals	36	Nurses	20
		Physicians	16
Design students	36	Portuguese Design Students	17
		German Design Students	19
N	72		

The total of 72 respondents (N=72) were divided in healthcare professionals (n=36) and design students (n=36). The first cluster is comprised of physicians (n=16) and nurses (n=20) most of them from several specialities and divisions of the Hospital de Santa Maria, CHLN in Lisbon. We made sure to have the necessary authorization to apply them. The latter is constituted by students of the IADE in Lisbon (n=17) and students from the BTK – University of Arts & Design in Berlin (n=19).

The opportunity of surveying German Design students, in addition to enrich the sample, offers the chance to study eventual differences in the design related cluster that could support eventual further studies.

Originally, we aspired to include working professionals with a Design background in our sample but that turned out to be impossible.

Further descriptive analysis of the sample is presented in the results chapter.

4.4 Methods & Tools

To undertake the present research in the form discussed before, we used several methods and tools, namely interviews, the study of curricular plans and a questionnaire.

The unstructured interview respondents were selected as mentioned before, and the interviews were conducted in person in the case of Prof. Rui Tato Marinho, and via Skype in the case of the designer Daniel Santos. The insights that emerged from those interviews and chosen to be presented in this document are of the author's responsibility, not before having the interviewees' validation and authorization.

The study of the current curricular plans of the chosen healthcare schools was done resorting to the documents publically displayed in the respective online pages (see Table 2).

Table 2
Curricular plans of healthcare courses.

institution	**course**	**document**
Faculdade de Medicina da Universidade de Lisboa	Medicine	Integrated Masters Course in Medicine
Faculdade de Medicina da Universidade do Porto	Medicine	Mestrado Integrado em Medicina – Plano oficial 2013
Faculdade de Medicina da Universidade de Coimbra	Medicine	Mestrado Integrado em Medicina
Escola Superior de Enfermagem de Lisboa	Nursing	Plano de Estudos
Escola Superior de Enfermagem do Porto	Nursing	Estudar na ESEP: Plano de Estudos
Escola Superior de Enfermagem de Coimbra	Nursing	Licenciatura em Enfermagem: Plano de Estudos

The questionnaires were filled in different moments. To collect the German design students' responses, we relied on Matthias Hübner, designer and lecturer at the BTK University of Art & Design, Berlin.

The Portuguese design students' responses were gathered by the researcher in the 12th of May at the IADE, Lisbon.

The health professional's responses were collected in several occasions, from April to July, given the right opportunities.

The statistically treatment to the data collected from the questionnaires was performed using IBM's SPSS, relying in Professor Paulo Ferreira expertise and the work of Bryman & Bell (2015).

The dissertation was written following the APA Publication Manual (2010) recommendations.

4.5 Questionnaire

The questionnaire was our main source of data collection and the instrument by which it was possible to understand if there were significant statistical differences in the dimensions that the literature review considered to be fundamental to the Design Thinking process between individuals with a design background and health professionals (see APPENDIXES A & B).

It is a self-completion instrument where the central independent variable (see section 4.5.1) is the background cluster, whereas the dependent variables studied were those that could explain an aptitude to participate in the Design Thinking process.

It became clear that de process of human-centred design is highly dependent of Empathy and Divergent Thinking. The first, primarily in the Empathy and Definition phases of the process or Inspiration, where understanding peoples' needs (what is desirable) is fundamental. The second, throughout the process, but mainly in the Empathise phase, where one searches ways of broadening the understanding of what the problem is, and in the Ideate phase, where creating a variety of creative and innovative solutions to those problems is necessary.

In an effort to understand if there were differences between individuals with a Design background and healthcare professionals on those dimensions, we chose to include two tests – the Toronto Empathy Questionnaire (see section 4.5.2) and the Alternative Uses Test (see section 4.5.3), which are both explained in following chapters.

Furthermore, we included nine questions that Blizzard et al. (2015) used to identify what they considered Design Thinking traits (see section 4.5.4).

To make sure the questionnaire was clear and understandable, we undertook a trial test involving 10 respondents.

4.5.1 Variables

As stated before, the main independent variable of the survey was the background of the respondents – healthcare professionals and design students. We deepened the study dividing those clusters in sub groups considering the profession or the education institution.

Besides the dependent variables that naturally emerge from the Toronto Empathy Questionnaire, the Alternative Uses Test and the Design Thinking traits test, some others were considered as the following table points.

Table 3
Questionnaire variables.

variable	label	values
cluster	background	Healthcare providers Design students
Sub-cluster	background	Nurses; Physicians; Portuguese Design students; German Design students;
age	Respondents' age arranged in intervals	18-25 26-35 36-45 > 45
gender	Respondents' gender	Female Male
Health care inner cluster (only applicable to healthcare providers)	Healthcare providers profession	Nurses Physicians
Professional experience (only applicable to healthcare providers)	Healthcare providers' years of practice arranged in intervals	< 5 years 5-10 years 11-20 years > 20 years
Professional practice (only applicable to healthcare providers)	Healthcare providers' practice domain	Public healthcare Private healthcare Both
Familiarity with the concept of DT (not applicable to healthcare providers)	If the respondents familiar with the concept	Yes No
Training in DT (not applicable to healthcare providers)	If the respondents had any training in DT	Yes No
Toronto Empathy Questionnaire Score	Overall Empathy Score	Score
DT traits score	Overall score considering 5 traits	Score/Sum (9 questions)
Feedback seekers	Willingness to look input from others to make decisions and change directions	Score/Sum (2 questions)
Integrative Thinking	Ability to analyse at a detailed and holistic level to develop novel solutions	Score/Sum (2 questions)
Optimism	Resilience to challenging problems	Score/Sum (2 questions)
Experimentalism	Willingness to ask questions and take new approaches to problem solving	Score/Sum (1 question)
Collaboration	Ability to work with many different disciplines and experience in more than one field	Score/Sum (2 questions)
Tolerance to smoking habits	How much the respondent tolerates others' smoking habits	Scale (0-4; none-a lot)
Tolerance to harmful alcohol consumption	How much the respondent tolerates others' alcohol abuse	Scale (0-4; none-a lot)

variable	label	values
Tolerance to harmful eating habits	How much the respondent tolerates others' harmful eating habits	Scale (0-4; none-a lot)
Current professional motivation (only applicable to healthcare professionals)	How much the respondent feels motivated professionally	Scale (0-4; none-a lot)
Divergent Thinking Score	Ratio	Score
Divergent Thinking flexibility	Number of different ideas	Score/Sum
Divergent Thinking fluency	Number of different categories	Score/Sum

The inclusion of three questions that quantify the respondents' tolerance to individuals' habits and the one that quantifies how much health providers felt professional motivated had the purpose of determining if there were additional correlations between variables that could deserve a further analysis.

4.5.2 Toronto Empathy Questionnaire

The assessment of the participants' Empathy was done using the Toronto Empathy Questionnaire scale (TEQ) proposed by Spreng, McKinnon, Mar and Levine (2009). It includes 16 questions that involve a wide range of attributes associated with the theoretical aspects of empathy.

Empathy is a fundamental component of social cognition for its contribution in the individual's capacity to understand and respond adaptively to other's emotions, in the success of emotional communication, and social behaviour promotion (Spreng et al., 2009).

For Davis (1980), this notion of responsivity to the other's experience has been discussed for over two centuries by social theorists, which, from almost the beginning, recognized a multidimensional nature of the phenomenon.

From the 18th century distinction between an instinctive and an intellectualised sympathy, the partition of empathy persisted to this day, currently divided as cognitive and emotional empathy. If the first may be defined as the capacity to understand how others experience the world from their point of view, the second may be an instinctive, affective and involuntary reaction to the other's experiences (Davis, 1980; Gasparini, 2015).

The theoretical perspective of Design in its relation with empathy, as proposed by Gasparini (2015), believes that in the process of solving wicked problems, cognitive empathy is far more important than the emotional one. The author claims that in the process of design

thinking, the designer searches and acquires a cognitive empathic understanding and insight, for instance simulating the others' actions (an experience prototype), without the need to feel what the real experiences are.

Understanding how much empathy one feels, though, is a rather hard task, despite the numerous approaches and measures created.

We opted to use the TEQ, a unidimensional scale built on the underlying consensus among several measures currently in use (Spreng et al., 2009). It is, as the authors describe it, a short, clear and homogenous scale with strong psychometric properties, validity and reliability.

We were aware that this tool didn't consider cognitive empathy alone, but as the same article points, there seems to be an overlap across both the affective and cognitive components and an intercorrelation of their responses, which may indicate shared processes between them. An interdependent system already advocated by Davis (1980) that also pointed the predictive superiority of considering both the aspects when accessing one's empathy.

4.5.3 Alternative Uses Test – Creativity Quotient

According to Collins (2013, p.36) "from the beginning, the process of Design Thinking was a means to deliver creativity".

For Runco (2004), creativity is more important now than ever before. Since it is a useful and effective response to evolutionary changes, it has a fundamental role in innovation and entrepreneurship and, thus, is now considered a key concern of organisations. "It facilitates problem-solving, self-expression, and health" (Runco, 2004, p. 677).

For Chasanidou et al. (2015), divergent thinking as a creativity attribute, fosters innovation as form of applying new knowledge.

When trying to do a psychometric approach to creativity, one of the more commonly used test is the Guilford's Divergent Thinking test (aka Alternative uses test). Hence, that was the tool we elected for our study.

Classically, the test tries to access one's ideational fluency, by asking a person to generate all possible uses for a familiar item.

Snyder, Mitchell, Bissomaier and Pallier (2004) revisited this approach, creating a mathematical expression, which considers both the number of ideas (fluency), but also the number of categories (flexibility) in which they may be distributed. Together and articulated

in that expression, the authors believe we're in the presence of a Creative Quotient, which may reflect the individual potential for creative thought.

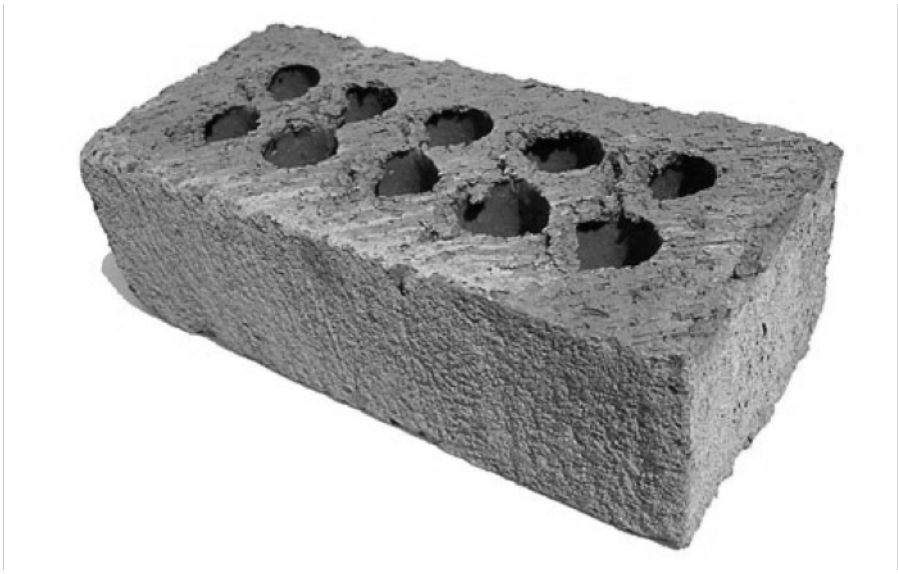

FIG. 9 – Alternative Uses Test object: brick

Source: retrieved from http://mailbricks.com/wp-content/uploads/2015/01/brick.png

We chose to ask our respondents to came up with all the alternative uses for a brick (see FIG. 9) and used the following equation suggested by Snyder et al. (2004) to determine their CQ:

$CQ = \log_2 [(1+u_1)\ (1+u_2)\ \ldots\ (1+u_c)]$, where u_1, u_2, and u_c are the numbers of uses offered in the respective category.

Besides this overall score, in our approach we chose to analyse both fluency and flexibility alone as well.

4.5.4 Design Thinking Traits test

Blizzard et al. (2015), following the contributions of several authors, propose a test to assess one's aptitude to Design Thinking's practise by focusing on five main traits: 1) the willingness to seek feedback; 2) integrative thinking; 3) optimism; 4) experimentalism and 5) collaboration.

In the authors' 9-question survey, each of the traits, except experimentalism (1 question), are scrutinised through 2 questions (see Table 4).

Table 4
Design Thinking traits.

Trait	Interpretation	Questions
Feedback seekers	they ask questions and look for input from others to make decisions and change directions	. I seek input from those with a different perspective from me . I seek feedback and suggestions for personal improvement
Integrative Thinking	they analyse at a detailed and holistic level to develop novel solutions	. I analyse projects broadly to find a solution that will have greatest impact . I identify relationships between topics from different courses
Optimism	they don't back down from challenging problems	. I can personally contribute to a sustainable future . Nothing I can do will make things better in other places on the planet
Experimentalism	they ask questions and take new approaches to problem solving	. When problem solving, I focus on the relationships between issues
Collaboration	they work with many different disciplines and often have experience in more than just one field	. I hope to gain general knowledge across multiple fields . I often learn from my classmates

Source: Blizzard et al. (2015). Using survey questions to identify and learn more about those who exhibit Design Thinking traits. Design Studies, 38, 92-110

In our research we followed the author's suggestion and analysed both the overall score given by the sum of all the questions, and of each trait individually.

4.6 Interviews

We chose to interview an expert on each of the two matters that we were determined to connect – human-centred design and healthcare. Therefore, we contacted both Daniel Santos, a Service Designer at FutureEverything in Manchester, and Prof. Rui Tato Marinho, Md and PhD, hepatologist at Hospital de Santa Maria in Lisbon, and associate professor at the Lisbon Medical School (FMUL).

Both the interviews should be considered unstructured. There was only a pre-established list of topics or questions meant to be addressed (SEE APPENDIXES C & D), but there was no

standard sequence to them, and there was latitude to give the respondents their own free contributions and ask further questions if that was the case (Bryman & Bell, 2015).

The first contact was made via email, by which we provided the basic framework supporting the study, what would be required from both of them, and the pertinence of their answers to the research. From that first moment, both showed great interest, enthusiasm and the willingness to participate.

We interviewed Daniel Santos in the 16th of June 2017 through Skype.

Prof. Rui Tato Marinho was interviewed in person in the 26th of July 2017.

5. RESULTS

In this chapter we point out the results gathered from the interviews, curricular plans' analysis and questionnaire.

5.1 Interviews

In the following paragraphs we try to point out the major contributions taken from the two interviews made. As said before, this more qualitative approach was meant to give strength (or contradict, if that would be the case) the insights taken from the literature review and what we expected would emerge from the quantitative analysis.

5.1.1 Interviewing Daniel Santos

For Daniel Santos Design Thinking and human-centred design are basically indivisible, since the first should always apply the latter's methodology to problem solving.

Design Thinking is, for him, the act of applying design process, tools and methodology to problem solving regardless of the focus – a toolkit to problem solving explicitly non-committal to the problem space, which makes it appealing for the business world, no matter the industry.

Human-centred design is putting the people for whom we're designing for at the heart of the process. It sets the focus in all the stakeholders rather than in costumers alone. People should be imbedded and the target of the decision-making process. Through observation and behavioural study, they provide evidence or insights (triggers) for further decisions.

For the expert, in the past, all the business areas and industries were based in standards. In a "business as usual" ethos. In the last decades, though, almost every one of them felt the need to embrace disruption to become more competitive or efficient. He exemplifies with the music industry, which found new channels to deliver its products; with the HRs market, which found in the emerging social networks a recruitment tool; with advertisement and retail. They all altered their mind-sets in a response to change.

Education, Health and Justice, however, are systems that for Daniel Santos seem to respond slower to change and need to be reinvented. This resistance may be due to their complexity and high level of hierarchy.

A Human-centred approach and Design Thinking tools could be helpful to those systems, but recognizing the probable opposition from the *status quo*, the designer thinks the best way to prove their legitimacy is to show results.

In terms of the healthcare system, he considers as a valid opportunity, the development of labs inside the organisations (e.g. hospitals) set to answer very limited and well-defined problems. Labs made out of designers and healthcare experts, which could produce outputs that, if pertinent, could foster further experiments in the near future. In the long-term, that could prove valid the inclusion of human-centred approach subjects in healthcare related courses.

For the time being, he claims the healthcare professionals should definitely be included in such projects, as long as they have the necessary drive or motivation.

Another possibility he considers is to deliver workshops to those individuals. Not only centred in the health realm, but rather in the human-centred discipline as a whole. Workshops developed to foster Empathy and Creativity, but also, transparency, trust, and collaboration.

When asked if those characteristics are in anyway more evident in designers than in other individuals, Daniel Santos considers that that isn't necessarily true. In fact, he points out that for instance Empathy is an innate feature of all individuals. It is the result of natural evolution and that we are biologically prepared for empathy. It's the social and cultural constructs that may numb that feature in healthy individuals. Design Thinking may nurture a reencounter with that inborn characteristic.

5.1.2 Interviewing Prof. Rui Tato Marinho

The physician and professor at the Lisbon Medical School agrees that besides the scientific and technological breakthroughs of the last decades, we're just not doing enough to mitigate health problems like chronic liver diseases, diabetes, chronic kidney disease, child obesity and others, which constitute a progressively heavier healthcare burden.

If those advances allowed better general healthcare and increased our life expectancy, at the same time they contributed to the aging and consequent frailty of the populations.

For the scholar, we live in times of avid consumerism. In a society obsessed with money and spending, which can explain the life habits that can lead to chronic diseases.

He considers the current communication plan of the health care agencies poor, and no match for the well oiled marketing, sales and lobbying processes of the companies that depend on that consumerism to thrive and prosper.

Although considering that there's a well-informed faction of the society in most cases with better resources and access to better healthcare and life habits, there are still some pockets of the population evidently more vulnerable.

Governments lack long term vision and commitment to regulate, and aren't effectively applying the law.

Taking the alcohol consumption prevention as an example, Rui Tato Marinho considers that in the case of Portugal, there's almost no promotion. Is it because it menaces the business? – he asks.

He claims that communication should be refocused on the individual and gives special relevance to healthcare education at schools, where an effort should be made to invest more.

When asked what was his perspective on the current curricular program of healthcare providers and if they are being prepared for answering complex health problems, the professor starts by telling that he considers students nowadays broadly interested, active and committed. The programs, tough, are still very linked and shaped to the professors' features rather than the students'. They are organised in silos with scarce interconnection. They lack focus on attitudes and on the ability to listen and transmit messages.

Finally, he considers that more investment should be made in communication and to push students to be more involved with the community.

5.2 Current curricular plans

As pointed before, we analysed the curricular plans of six different institutions devoted to healthcare education, namely in the fields of Medicine and Nursing (see section 4.4).

As expected, in none of the documents, that is to say, in none of the plans, we could identify a single course or subject evidently devoted to human-centred strategies or design-thinking.

Despite that, given the objectives presented for the curricular programs, it would make sense to include it in the healthcare professionals' education. Take the following examples:

"To train Medical Practitioners with solid scientific training, self-learning skills and the capacity for *lifelong learning,* with the necessary skills to communicate with patients, peers and the Society in general, who are able to work as part of multidisciplinary professional teams, who are aware of modern Health challenges and Ethics in Medicine and Life Sciences, who are fit for a useful and creative integration into the Health Systems currently in place in our Society, and who are able to make informed decisions regarding their professional career." (FMUL, n.d.).

"The Master in Medicine at FMUP is to develop a comprehensive medical education in order to make FMUP students reference professionals, equipped with the necessary skills to improve people's health, through excellence in clinical practice, research, innovation and leadership." (FMUP, n.d.).

"Train nurses who show problem-solving ability within human responses to health problems and processes of transition of individuals, groups and communities, and constructing and justifying their own arguments." (ESEnfC, n.d.).

In fact, a thorough analysis, given the content available of the six curricular plans, documents the relevance of the more scientific, analytical, orthodox subjects, in favour of a broader, social, environmental focus.

Table 5

Subjects suitable for integrating Design Thinking.

institution	**course**	**subject**
Faculdade de Medicina da Universidade de Lisboa	Medicine	. Clinical medicine: the physician, the person, the patient . Public health/Epidemiology/Genetics . Communication in Health*
Faculdade de Medicina da Universidade do Porto	Medicine	. Social and Humane Education* . Strategic Marketing and Communication applied to the Health*
Faculdade de Medicina da Universidade de Coimbra	Medicine	. Introduction to Social Medicine and Global Health . Research Methods/Population Health
Escola Superior de Enfermagem de Lisboa	Nursing	. Contemporary Tendencies in Health . Entrepreneurship in Nursing*
Escola Superior de Enfermagem do Porto	Nursing	. Socioantropology . Entrepreneurship*
Escola Superior de Enfermagem de Coimbra	Nursing	. Health Socio-Anthropology . Health Education

*optional subject

Nevertheless, in each one of them, we identified a couple of units that leave room for human-centred design to be incorporated, if not in a more dense matter, in the form of seminars or workshops (see Table 5).

5.3 Statistical treatment of the Questionnaire

In the present chapter we'll present the necessary statistical input generated by the questionnaire and that served to support our main findings. Along with the literature review, the interviews and the curricular analysis, it allowed us to formulate our posterior discussion.
As pointed before, we made use of the SPSS digital tool to create the statistical inputs.

5.3.1 Descriptive analytics

Generally, the questionnaire sample was already addressed in the methodology chapter, in particular the respective frequencies of respondents in terms of the clusters and sub-clusters created.
The following tables and graphics give some further descriptive perspective.
We've managed to obtain an identical number of respondents from each group (Health professionals and Design students). The number of respondents of each of the four sub-clusters varies between 22,2% and 27,8% (see Table 6).

Table 6
Cluster and sub-cluster distribution.

Cluster	**n**	**%**	**Sub-cluster**	**n**	**%**
Healthcare professionals	36	50	Nurses	20	27,8
			Physicians	16	22,2
Design students	36	50	Portuguese Design Students	17	23,6
			German Design Students	19	26,4
N	72				100

The total sample is constituted by 49 (aprox. 68%) female individuals and 23 (aprox. 32%) male respondents. The age distribution follows the distribution presented in the following figure (FIG 10).

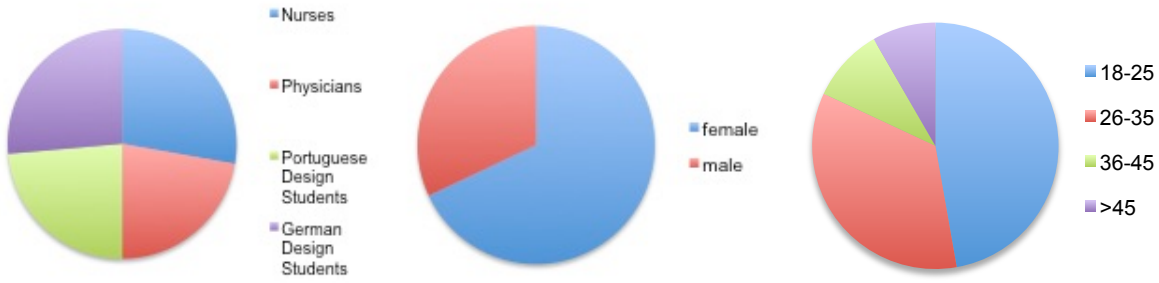

FIG. 10 – Sample's cluster, gender and age distribution

Both the gender and age distribution are presented by cluster in tables 7 and 8.

Table 7
Gender by cluster.

Cluster	Gender			
	female		male	
	n	%	n	%
healthcare professionals	22	61,1	14	38,9
design students	27	75,0	9	25,0

Table 8
Age by cluster.

Cluster	Age interval							
	18-25		26-35		36-45		> 45	
	n	%	n	%	n	%	n	%
healthcare professionals	2	5,6	21	58,3	7	19,4	6	16,7
design students	32	88,9	4	11,1	-	-	-	-

5.3.2 Means and normal distribution of the main dependent variables

Since we were determined to verify if there were some significant statistical differences between clusters in terms of the characteristics that are essential to the Design Thinking process, according to the UCLA (n.d.) before choosing the appropriate test, one should verify the normal distribution of each variable for each cluster alone. We used the Shapiro-Wilk test for that purpose, which for Ghasemi and Zahediasl (2012) and Razali and Wah (2011) provides a better power than the Kolmogorov-Smirnov test.

Tables 9 and 10 synthesise the results of that test to the variables we considered as fundamental to our research for the two clusters.

Table 9

Descriptive statistics & Shapiro-Wilk test of normality (healthcare professionals).

Cluster	Variable	M	SD	Test stat
Healthcare professionals	TEQ Score	45,330	4,997	0,943*
	Feedback Seekers	5,917	1,574	0,917**
	Integrative Thinking	5,722	1,233	0,888***
	Optimism	5,694	1,451	0,868***
	Experimentalism	2,944	0,674	0,799***
	Collaboration	6,694	0,98	0,846***
	DT Traits Score	26,972	4,003	0,963
	Creative Fluency	4,360	2,463	0,805**
	Creative Flexibility	3,190	1,489	0,926***
	Creative Quotient	3,758	1,741	0,905***

Note: * p<0,1 ** p<0,5 *** p<0,01

Table 10

Descriptive statistics & Shapiro-Wilk test of normality (design students).

Cluster	Variable	M	SD	Test stat
Design students	TEQ Score	45,750	5,239	0,969
	Feedback Seekers	5,944	1,492	0,884***
	Integrative Thinking	5,417	0,841	0,864***
	Optimism	5,639	1,355	0,924**
	Experimentalism	2,722	0,741	0,835***
	Collaboration	6,528	1,183	0,887***
	DT Traits Score	26,250	1,225	0,930**
	Creative Fluency	4,390	1,644	0,955
	Creative Flexibility	3,610	1,225	0,934**
	Creative Quotient	4,073	1,439	0,969

Note: * p<0,1 ** p<0,5 *** p<0,01

The output generated proved that, with a 95% confidence interval, only the TEQ Score observed a normal distribution in both samples.

Bearing in mind these results, we proceeded in comparing the two clusters making use of parametric instruments for that variable, and non-parametric tests for the remaining.

5.3.3 Comparing the TEQ Score results of Healthcare professionals and Design students

As just mentioned before, to analyse the differences between the two groups in this variable we used a parametric test, namely the Independent samples t-test for equality of means.

Considering the test hypothesis:

H0.1: There's no difference between healthcare professionals and design students in terms of Empathy

And its alternative counterpart:

H1.1: There are differences between healthcare professionals and design students in terms of Empathy

Applying the test (see Table 11) one should not reject the null hypothesis and, thus, consider that there isn't significant evidence of differences between the groups in terms of Empathy.

Table 11

Independent samples t-test (TEQ Score).

	Healthcare professionals		Design students			
Outcome	M	SD	M	SD	df	t
	45,33	4,997	45,75	5,239	70	-0,345

Note: * p<0,1 ** p<0,5 *** p<0,01

5.3.4 Comparing the DT traits Score, AUT score, creative fluency and flexibility, and performance in terms of the individual DT Traits of Healthcare professionals and Design students

As seen before (see section 5.3.2), these variables, because they don't verify the principle of normal distribution of results for each cluster, should be addressed with non-parametric statistical tools. We've chosen the Mann-Whitney test for that purpose.

Therefore, considering the following test hypotheses:

H0.2: There's no difference between healthcare professionals and design students in terms of Creativity

H0.3: There's no difference between healthcare professionals and design students in terms of any other significant Design Thinking traits (DT traits overall score)

H0.4: There's no difference between healthcare professionals and design students in terms of the Feedback Seeking trait

H0.5: There's no difference between healthcare professionals and design students in terms of the Integrative Thinking trait

H0.6: There's no difference between healthcare professionals and design students in terms of the Optimism trait

H0.7: There's no difference between healthcare professionals and design students in terms of the Experimentalism trait

H0.8: There's no difference between healthcare professionals and design students in terms of the Collaboration trait

H0.9: There's no difference between healthcare professionals and design students in terms of Creative Fluency

H0.10: There's no difference between healthcare professionals and design students in terms of Creative Flexibility

And their alternative counterparts:

H1.2: There are differences between healthcare professionals and design students in terms of Creativity

H1.3: There are differences between healthcare professionals and design students in terms of any other significant Design Thinking traits (DT traits overall score)

H1.4: There are differences between healthcare professionals and design students in terms of the Feedback Seeking trait

H1.5: There are differences between healthcare professionals and design students in terms of the Integrative Thinking trait

H1.6: There are differences between healthcare professionals and design students in terms of the Optimism trait

H1.7: There are differences between healthcare professionals and design students in terms of the Experimentalism trait

H1.8: There are differences between healthcare professionals and design students in terms of the Collaboration trait

H1.9: There are differences between healthcare professionals and design students in terms of Creative Fluency

H1.10: There are differences between healthcare professionals and design students in terms of Creative Flexibility

Applying the test (see Table 12), one should not reject, with a 95% confidence interval, any of the null hypotheses and, therefore, consider that there aren't significant differences between healthcare professionals and design students in terms of all the dimensions.

Table 12
Mann-Whitney U test (remaining dependent variables).

Variable	Cluster	N	Mean Rank	Sum of Ranks	U	Z
DT traits Score	Health professionals	36	37,78	1360,00		
	Design students	36	35,22	1331,50		
	Total	72			602,000	-0,521
Feedback	Health professionals	36	36,29	1306,50		
	Design students	36	36,71	1321,50		
	Total	72			640,500	-0,087
Integrative Thinking	Health professionals	36	38,46	1384,50		
	Design students	36	34,54	1243,50		
	Total	72			577,500	-0,837
Optimism	Health professionals	36	36,39	1310,00		
	Design students	36	36,61	1318,00		
	Total	72			644,000	-1,166
Experimentalism	Health professionals	36	39,08	1407,00		
	Design students	36	33,92	1221,00		
	Total	72			555,000	-1,166
Collaboration	Health professionals	36	37,54	1351,50		
	Design students	36	35,46	1276,50		
	Total	72			610,500	-0,442
Creative Fluency	Health professionals	36	34,39	1238,00		
	Design students	36	38,61	1390,00		
	Total	72			572,000	-0,876
Creative Flexibility	Health professionals	36	32,83	1182,00		
	Design students	36	40,17	1446,00		
	Total	72			516,000	-1,529
Creative Quotient	Health professionals	36	33,33	1200,00		
	Design students	36	39,67	1428,00		
	Total	72			534,000	-1,295

Note: * p<0,1 ** p<0,5 *** p<0,01

5.3.5 Age as an hypothetical bias

It seemed fair to question, though, if age and subsequent life experiences may interfere in the Empathy, Creative and DT traits scores of the individuals and, because there is an evident difference in the distribution of the respondents by age between the two clusters (note that none of the design students respondent is in the two upper age intervals), we've decided to test if in fact there were statistical significant differences in those scores according to age.

For that matter, we've started by verifying the normal distribution of the dependent variables, this time splitting the files according to the age variable. The outputs generated (see APPENDIX E) show that only the TEQ Score and the DT traits Score verify a normal distribution in all of the four age intervals. For those two variables we proceeded by analysing hypothetical significant differences using the One-way ANOVA (see Table 13). For the remaining we used the Kruskal-Wallis test (see Table 14).

Table 13
One-way ANOVA test (TEQ Score & DT traits Score).

Variable	Cluster	Sum of squares	df	Mean square	F
TEQ Score	Between groups	19,178	3	6,393	0,239
	Within groups	1818,697	68	26,746	
	Total	1837,807	71		
DT traits Score	Between groups	11,807	3	3,936	0,271
	Within groups	989,304	68	14,549	
	Total	1001,111	71		

Note: * p<0,1 ** p<0,5 *** p<0,01

Table 14
Kruskal Wallis test (remaining variables).

Variable	Chi-square	df
Feedback Seekers	0,439	3
Integrative Thinking	1,876	3
Optimism	2,454	3
Experimentalism	4,120	3
Collaboration	0,169	3
Creative Fluency	0,761	3
Creative Flexibility	0,794	3
Creative Quotient	0,273	3

Note: * p<0,1 ** p<0,5 *** p<0,01

Once none of the null hypotheses should be rejected with a 95% confidence interval, the results don't show any significant difference between the age intervals in terms of any of the dependent variables.

5.3.6 Healthcare professionals' Motivation and Empathy

In parallel to the main focus of this research, and because we asked our health professionals to grade their motivation at work, we decided to verify if there was any correlation between that variable and the Empathy (TEQ Score) results.

Applying the Kendall's correlation test (see Table 15), $r = 0{,}252$ $p > 0.05$, one should reject the hypothesis of correlation with a 95% confidence interval. Nevertheless, because the 2-tailed p value is 0,062, $r = 0.252$, $p < 0.1$, some positive correlation between the work motivation and Empathy exhibited by healthcare providers may be accepted with a weaker confidence interval.

Table 15

Kendall's correlation test (Motivation & Empathy).

		Motivation
TEQ Score	Correlation Coefficient	0,252*

Note: * p<0,1 ** p<0,5 *** p<0,01

5.3.7 Tolerance to harmful life habits in Health professionals and Design students

In our questionnaire we included three questions that were meant to access the individuals' tolerance towards people who exhibit harmful life habits. We were keen on discovering if the exposure to illness (by healthcare professionals) could affect the tolerance towards individuals with those habits and therefore their unprejudiced treatment.

In both groups (healthcare professionals and design students), the results for each of the three questions don't observe a normal distribution (see APPENDIX G).

Therefore, we proceeded in analysing the eventual differences using the Mann Whitney U test (see Table 16).

Table 16

Mann-Whitney U test (differences in tolerance towards harmful habits).

Variable	Cluster	N	Mean Rank	Sum of Ranks	U	Z
Tolerance to smoking habits	Health professionals	36	40,04	1441,5	520,500	-1,501
	Design students	36	32,96	1186,5		
	Total	72				
Tolerance to harmful alcohol consumption	Health professionals	36	39,36	1417	545,000	-1,214
	Design students	36	33,64	1211		
	Total	72				
Tolerance to harmful eating habits	Health professionals	36	34,19	1231	565,000	-0,979
	Design students	36	38,81	1397		
	Total	72				

Note: * p<0,1 ** p<0,5 *** p<0,01

Given the results, one cannot affirm with any level of confidence that there are any significant differences between healthcare professionals and other individuals regarding their tolerance towards the harmful habits studied.

Again, these results should be regarded with the necessary cautiousness given the size of the sample and clusters.

6. DISCUSSION

In the present chapter we try to connect both the inputs from the literature review and from the research results in order to withdraw the subsequent insights and conclusions.

6.1 Healthcare *status quo*

The literature review highlights the advances in healthcare of the last decades but at the same time recognizes the modest overall accomplishments in terms of the prevalence of some multidimensional diseases such as NCDs (see section 2.3.1 & 2.3.2), an opinion corroborated by prof. Rui Tato Marinho in his intervention (see section 5.1.2).

Several authors defend that healthcare generally, and diseases specifically, are complex systems influenced by the non-linear interaction of determinants that go beyond biology and behaviour. They're also influenced by environmental, political, social and economical factors (see section 2.3.1).

This complexity and furthermore hierarchy are what for Daniel Santos make healthcare slower when answering to change (see section 5.1.1).

Despite the need to understand health in a more comprehensive model, the traditional, analytical, reductionist method represents a serious obstacle to that purpose (see section 2.3.1).

For prof. Rui Tato Marinho the lack of long-term vision and commitment of the governments and the power of companies that depend on potential harmful life habits to thrive, also contribute to this resistance (see section 5.1.2).

Understanding health as a complex system should enhance a systemic approach replacing reductionism as the main source of research and problem solving, mitigating the silos effect (see sections 2.2.1; 2.2.2 & 2.3.1).

Nevertheless, traditional academic environments, such as medical schools, persist on focusing on an analytical-centred education and memorization (see section 2.3.4).

For prof. Rui Tato Marinho, education is still organised in silos of knowledge and shaped by the professors' features, lacking focus on attitudes, communication and fostering the involvement of the students with the community (see section 5.1.2).

Although it seems clear the willingness of both medical and nursing schools to prepare future health professionals in a dynamic innovative perspective, the study undertaken of the curricular plans, reveals that the majority of subjects still favour a more scientific, analytical, physiological-centred focus (see section 5.2).

6.2 Design Thinking and Healthcare

The literature review enabled us to build a bridge between systems thinking, understood as the needed wholeness perspective method of approaching health complexity, and Design Thinking (see section 2.2.3).

The process of Design Thinking considers indispensable the definition of a starting point to problem solving, which should be done following the holistic perspective that Systems Thinking offers.

Empathy, which is the starting point of the Design Thinking process, can also be understood as a link to the systemic approach to complex problems, namely those that are health related, since it is essential to consider the human complexity to that purpose.

Design Thinking can moreover lend its sensibility in the solution domain and its iterative nature to address complex problems. Through creativity, in an exercise of abductive reasoning, it may suggest what can possibly be true before orthodox analysis takes over (see section 2.2.3). Its synthetic and real focused process of thinking may configure a valid complement to science and medicine (see section 2.3.4).

Also because human-centred, and for that matter focused on people's needs, it may help to deliver the desirable perspective when addressing complex healthcare problems, complementing the predominant feasible outlook (see sections 2.1.2 & 2.3.3).

Both the literature review and Daniel Santos agree that the best way to institutionalise Design Thinking, overcome the expected resistance towards prototyping and creative experimentation and legitimate the process, should be the development of small-scale projects in multidisciplinary labs created within the existing organisations, as the Helix Centre in St. Mary's Hospital, London is a good example of.

All of this alone, may point to the fact that one should defend the integration of design related subjects, namely human-centred design supported in Design Thinking methods, in the

healthcare professionals education and, thus, support the main hypothesis (**H)**. Nevertheless, we deepened our understanding of the question as the following sections demonstrate.

6.3 Design Thinking and Healthcare curricular plans

As claimed before, both the literature review and the interviewees share the belief of the need of restructuration of the curricular plans of healthcare education institutions.

Some statements presented by the institutions analysed regarding the objectives of their respective courses reveal a general willingness and intention to provide an innovative, broad focused and comprehensive education (see section 5.2).

Despite this unanimity, the research undertaken of the curricular plans of the same sample of institutions demonstrates the absolute authority of the orthodox subjects over those more transversal and that could make bridges across silos of knowledge and privilege a broader understanding of people, patients, and problems.

Moreover and as expected, none of the subjects of any of the curricular plans regards explicitly Design Thinking or Human-centred Design, thus confirming **H1**.

That being said, though, some current subjects (see Table 5) suggest some hypothetical proximity that could allow the inclusion of Design Thinking.

6.4 Healthcare professionals' aptitude to Design Thinking

Acknowledging the pertinence of applying Design Thinking methods to healthcare complex problems is not the same as saying that healthcare professionals should take part in that process.

In the literature review, though, the idea of multidisciplinary as a premise to Design Thinking was recurrent (see section 2.1.3). Furthermore, the designer interviewed states that those professionals should definitely be included in health related projects and that seems to be the case in the several existing practical examples (see section 5.1.1).

Our quantitative approach was set on finding if there were significant differences between individuals that would be naturally associated to this kind of process, namely designers, and the same healthcare providers.

Considering the importance of Empathy, Divergent Thinking (Creativity) and the traits identified by Blizzard et al. (2015) and applying a set of related tests to design students and physicians and nurses, we couldn't find significant evidence of such differences. Thus, not rejecting he hypotheses **H2**, **H3** and **H4**, seems fair to say that there aren't any impediments to healthcare professionals, given the proper training, to participate in Design Thinking teams set to address complex health problems.

That gives strength to the claim that people outside professional design may exhibit natural aptitude for Design Thinking given the appropriate opportunities and, therefore, take place on the process yon consulting.

Because there was a considerable difference on the age distribution of the individuals between the two groups, we studied if age itself could bias the results of the main dependent variables. There was no evidence of significant differences between age intervals for any of those variables (see section 5.3.5).

6.5 Further analysis

There seems to be some correlation between the healthcare professionals' expressed work Motivation and their Empathy (TEQ Score) (see section 5.3.6). These results should be carefully accepted bearing the small size of the sample and the test result itself. Nevertheless, they may point to a decrease on Empathy manifested by health professionals when less motivated and, therefore, in their ability not only to participate in Design Thinking projects, but also to address patients as expected in their daily functions. Further studies are recommended, but it may suggest in advance the need for managers to consider the motivation of healthcare professionals.

We found no significant differences between healthcare professionals and the respondents outside the health sector sphere in terms of their claimed tolerance towards three harmful life habits – smoking, alcohol addiction and eating disorders in obese people (see section 5.3.7).

6.6 Limitations of the research

When we defined our main quantitative approach, that is, our questionnaire, we thought it would be easier to get a more substantial number of respondents.

The size of the sample, especially when comparing the two main clusters, advices some wariness when analysing the results.

Also, originally, it was our intention to have a third sub-cluster in the design background individuals constituted by working professionals. Our several approaches to several companies were frustrated, even after some of them showed initial willingness in participating. We feel that by comparing students alone with healthcare professionals, could have slightly biased the results. It's possible that a professional experience can have an influence in the respondents' attitudes and subsequent answers.

The Alternative Uses Test presupposed the answering timing, which made it impossible to deliver the questionnaire in other way than in person. That fact constrained the total number of respondents obtained and, at the same time, could have had a negative impact on the full honesty of the answers, namely in the TEQ, since it made the questionnaire vulnerable to the Hawthorne effect.

Finally, despite the individual validity of the instruments used to measure the respondents' aptitude to participate in Design Thinking projects, we would have preferred to use more experimental strategies, which could place the subjects in practical experiences rather than a self-completion exercise.

6.7 Suggestions for future research

First and foremost, accepting the pertinence, scope and method of the present research, as well as the suitability of the chosen tests to access the main dependent variables, replicating the study but with a broader sample of healthcare professionals and design students should probably grant additional validity to the results. Also, it would be interesting, as originally intended by this research, to include a sub-cluster constituted of design professionals.

Preferably, though, we would like to deepen the understanding of the aptitude of health professionals to participate in Design Thinking methods making use of more experimental methods (e.g. application of tangible problems).

Additionally, future research could address not only the pertinence of Design Thinking as a method to tackle complex problems within a specific domain, but also as a tool to aid in the developing of organisational cultures.

On a personal level, if appropriate enough, it would be a privilege to see these and future findings published.

On a wider scale, the researcher would like to keep enlarging is knowledge on the matter, undertaking further research, lecturing, consulting and promoting Design Thinking, human-centred design and entrepreneurship either in a educational level, as well as at management and operational settings.

Also, assuming the pertinence of the method to tackle complex health problems, it would be of the upmost interest of the researcher to create, develop, participate and manage a multidisciplinary team focused on one particular problem within a willing health organisation.

CONCLUSION

Given the analysis presented in the previous chapter, namely the results' discussion and the research limitations recognised, some assertions can be made.

Accepting health as a complex system vulnerable to continuous change and that the orthodox Cartesian method is still evidently unable to mitigate some complex health problems, it seems fair to say that a Systems Thinking approach is necessary. An approach that accepts the nonlinear nature of the system, that is to say, not only the knowledge of its parts, but also the understanding of the dynamic relations between them. An approach that, by accepting the multidimensional source of complex problems, encourages working across silos of knowledge.

Design Thinking, because iterative, optimistic, multidisciplinary, solution focused through Creativity but at the same time open to reframing complex problems through Empathy, could be helpful when addressing complex health problems with this new perspective.

Moreover, the Design process of thinking alone may offer an interesting complement to Science and Medicine.

The best way to prove the method's pertinence and overcome the expected resistance of the *status quo* seems to be the implementation of small-scaled labs or work groups focused on addressing particular and well-defined issues within the existing organizations.

Projects that foster and depend on multidisciplinarity and thus, should include healthcare professionals in a quality that goes beyond consultancy.

Our research showed no significant difference between healthcare and design background individuals in terms of the necessary characteristics for participating in such projects, namely Empathy, Creativity and other traits, which suggests that there's no impediment to their involvement, given the proper training. The results, though, should be analysed carefully considering the size of the sample.

Several experts claim that healthcare courses should evolve to become more widely comprehensive and at the same time focused on students and the environment, rather than on the scholars and their particular respective silos of knowledge.

Taking the Portuguese reality as example, the healthcare education institutions seem to realize that necessity, claiming the ambition to prepare the future professionals for the present challenges with innovative and creative approaches. Nevertheless, they are still mainly anchored in traditional and analytical subjects. They include a few, though, that seem to leave

room for the inclusion of human-centred design and Design Thinking. If not evidently involved, the method could be introduced in seminars or workshops.

In conclusion, the present work seems to point to the pertinence of including Design Thinking when addressing complex health problems given the current opportunities, and to the aptitude of healthcare professionals to participate in such projects.

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APPENDIX A. – Health professionals questionnaire

This survey was designed as a support tool for my Master thesis in Management an Business Strategy that I'm currently doing at the Universidade Europeia, Laureate International Universities in Lisbon.

Specifically, we pretend to understand the health care professionals competence to incorporate multidisciplinary teams with the objective of developing innovative strategies to address complex health issues. Your participation is voluntary and your anonymity will be kept as well as the confidentiality of your answers.

I appreciate your willingness to help
Gonçalo Vaz

PART I

Age

18-25	26-35	36-45	>45
○	○	○	○

Gender

Female	○
Male	○

What's your profession?

Nurse	○
Physician	○

For how long?

<5 anos	5-10 anos	11-20 anos	>20 anos
○	○	○	○

Where?

public sector	○
private sector	○
both	○

PART II

TEQ

Below you'll find a list of statements. Please read each statement carefully and rate how frequently you feel or act in the manner described. Fill the circle of your answer on the response form. There are no right or wrong answers or trick questions. Please answer each question as honestly as you can.

	Never	Rarely	Sometimes	Often	Always
When someone else is feeling excited, I tend to get excited too.	○	○	○	○	○
Other people's misfortunes do not disturb me a great	○	○	○	○	○
It upsets me to see someone being treated disrespectfully.	○	○	○	○	○
I remain unaffected when someone close to me is	○	○	○	○	○
I enjoy making other people feel better.	○	○	○	○	○
I have tender, concerned feelings for people less fortunate than me.	○	○	○	○	○
When a friend starts to talk about his\her problems, I try to steer the conversation towards something else.	○	○	○	○	○
I can tell when others are sad even when they do not say anything.	○	○	○	○	○
I find that I am "in tune" with other people's moods.	○	○	○	○	○
I do not feel sympathy for people who cause their own serious illnesses.	○	○	○	○	○
I become irritated when someone cries.	○	○	○	○	○
I am not really interested in how other people feel.	○	○	○	○	○
I get a strong urge to help when I see someone who is upset.	○	○	○	○	○

	Never	Rarely	Sometimes	Often	Always
When I see someone being treated unfairly, I do not feel very much pity for them.	○	○	○	○	○
I find it silly for people to cry out of happiness.	○	○	○	○	○
When I see someone being taken advantage of, I feel kind of protective towards	○	○	○	○	○

DTTraits

Please consider the following statements. Read them carefully and making use of the suggested scale, explain to what extent do you disagree or agree with each one. Please answer as honestly as possible. There are no right or wrong answers.

	strongly desagree 0	1	2	3	strongly agree 4
I seek input from those with a different perspective from me	○	○	○	○	○
I identify relationships between topics from different	○	○	○	○	○
I analyze projects broadly to find a solution that will have the greatest impact	○	○	○	○	○
when problems solving, I focus on the relationship between issues	○	○	○	○	○
I can personally contribute to a sustainable future	○	○	○	○	○
Nothing I can do will make things better in other places on the planet	○	○	○	○	○
I seek feedback and suggestions for personal improvement	○	○	○	○	○
I hope to gain general knowledge across multiple fields	○	○	○	○	○
I often learn from my classmates	○	○	○	○	○

In the next few steps, please clarify your level of tolerance towards the behaviours presented making use of the suggested scale

What's your tolerance towards people with smoking habits?

none ○ ○ ○ ○ ○ a lot

What's your tolerance towards people with an alcohol addiction?

none ○ ○ ○ ○ ○ a lot

What's your tolerance towards people with an obesity problem who maintain harmful eating habits?

none ○ ○ ○ ○ ○ a lot

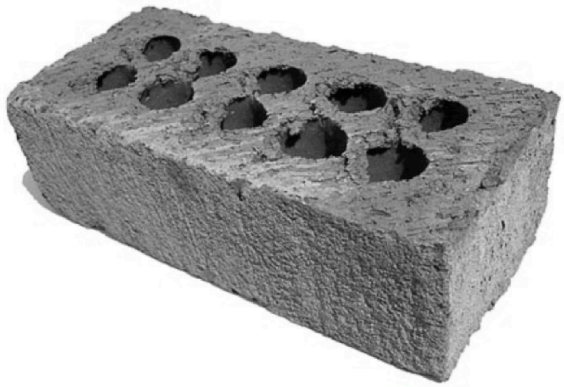
Use the following scale to rank your current professional motivation

nenhuma ○ ○ ○ ○ ○ muita

PART III

AUTest

Please consider the following object and, making use of your creativity, write down as many alternative uses for it. You have 2 min.



_____	_____
_____	_____
_____	_____
_____	_____

Thank you

APPENDIX B. – Design students questionnaire

This survey was designed as a support tool for my Master thesis in Management an Business Strategy that I'm currently doing at the Universidade Europeia, Laureate International Universities in Lisbon.

Specifically, we pretend to understand the health care professionals competence to incorporate multidisciplinary teams with the objective of developing innovative strategies to address complex health issues.

Your participation is voluntary and your anonymity will be kept as well as the confidentiality of your answers.

I appreciate your willingness to help
Gonçalo Vaz

PART I

Age

18-25	26-35	36-45	>45
◯	◯	◯	◯

Gender

Female ◯
Male ◯

Are you familiar with the concept of Design Thinking?

Yes ◯
No ◯

Have you ever had training in Design Thinking?

Yes ◯
No ◯

PART II

TEQ

Below you'll find a list of statements. Please read each statement carefully and rate how frequently you feel or act in the manner described. Fill the circle of your answer on the response form. There are no right or wrong answers or trick questions. Please answer each question as honestly as you can.

	Never	Rarely	Sometimes	Often	Always
When someone else is feeling excited, I tend to get excited too.	○	○	○	○	○
Other people's misfortunes do not disturb me a great	○	○	○	○	○
It upsets me to see someone being treated disrespectfully.	○	○	○	○	○
I remain unaffected when someone close to me is	○	○	○	○	○
I enjoy making other people feel better.	○	○	○	○	○
I have tender, concerned feelings for people less fortunate than me.	○	○	○	○	○
When a friend starts to talk about his\her problems, I try to steer the conversation towards something else.	○	○	○	○	○
I can tell when others are sad even when they do not say anything.	○	○	○	○	○
I find that I am "in tune" with other people's moods.	○	○	○	○	○
I do not feel sympathy for people who cause their own serious illnesses.	○	○	○	○	○
I become irritated when someone cries.	○	○	○	○	○
I am not really interested in how other people feel.	○	○	○	○	○
I get a strong urge to help when I see someone who is upset.	○	○	○	○	○

	Never	Rarely	Sometimes	Often	Always
When I see someone being treated unfairly, I do not feel very much pity for them.	○	○	○	○	○
I find it silly for people to cry out of happiness.	○	○	○	○	○
When I see someone being taken advantage of, I feel kind of protective towards	○	○	○	○	○

DTTraits

Please consider the following statements. Read them carefully and making use of the suggested scale, explain to what extent do you disagree or agree with each one. Please answer as honestly as possible. There are no right or wrong answers.

	strongly desagree 0	1	2	3	strongly agree 4
I seek input from those with a different perspective from me	○	○	○	○	○
I identify relationships between topics from different	○	○	○	○	○
I analyze projects broadly to find a solution that will have the greatest impact	○	○	○	○	○
when problems solving, I focus on the relationship between issues	○	○	○	○	○
I can personally contribute to a sustainable future	○	○	○	○	○
Nothing I can do will make things better in other places on the planet	○	○	○	○	○
I seek feedback and suggestions for personal improvement	○	○	○	○	○
I hope to gain general knowledge across multiple fields	○	○	○	○	○
I often learn from my classmates	○	○	○	○	○

In the next few steps, please clarify your level of tolerance towards the behaviours presented making use of the suggested scale

What's your tolerance towards people with smoking habits?

none ○ ○ ○ ○ ○ a lot

What's your tolerance towards people with an alcohol addiction?

none ○ ○ ○ ○ ○ a lot

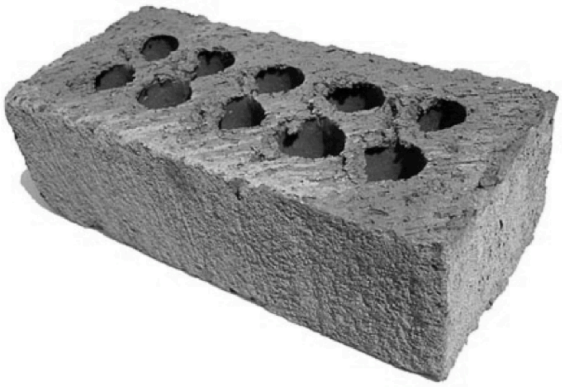
What's your tolerance towards people with an obesity problem who maintain harmful eating habits?

none ○ ○ ○ ○ ○ a lot

PART III

AUTest

Please consider the following object and, making use of your creativity, write down as many alternative uses for it. You have 2 min.



_____ _____

_____ _____

_____ _____

_____ _____

Thank you

APPENDIX C. – Daniel Santos interview guide

What is Design Thinking in your perspective?

What role do you think Design Thinking can have in solving complex problems, namely in the health sector?

What role can the health professionals in particular have?

What are the main traits a design thinker should manifest?

How important are Empathy and Creativity in that process?

Do you agree that the more traditionally analytical courses should include strategic design in their curriculum?

APPENDIX D. – Prof. Rui Tato Marinho interview guide

What's your point of view on the current prevalence of NCDs and of their underlying risk factors?

How do you characterize the investment on treating liver diseases against what is spent on prevention?

How do you see the current disease prevention and health promotion strategies? What do you reckon should be maintained and where should more investment be made?

What's your thought regarding the health professionals readiness to address complex health problems?

APPENDIX E. – Normality test for dependent variables sorted by age

Descriptive statistics & Shapiro-Wilk test of normality (age 18-25).

Cluster	Variable	M	SD	Test stat
Age 18-25	TEQ Score	46,00	4,703	0,968
	Feedback Seekers	6,00	1,557	0,885***
	Integrative Thinking	5,106	0,960	0,865***
	Optimism	5,676	1,387	0,918**
	Experimentalism	2,794	0,770	0,838***
	Collaboration	6,662	1,206	0,874***
	DT Traits Score	26,529	3,894	0,947*
	Creative Fluency	4,090	1,422	0,947*
	Creative Flexibility	3,440	1,113	0,923**
	Creative Quotient	3,845	1,259	0,969

Note: * p<0,1 ** p<0,5 *** p<0,01

Descriptive statistics & Shapiro-Wilk test of normality (age 26-35).

Cluster	Variable	M	SD	Test stat
Age 26-35	TEQ Score	44,920	5,560	0,986
	Feedback Seekers	5,840	1,491	0,909**
	Integrative Thinking	5,600	1,080	0,885***
	Optimism	5,800	1,354	0,900**
	Experimentalism	2,720	0,614	0,764***
	Collaboration	6,640	0,952	0,853***
	DT Traits Score	26,600	3,819	0,927*
	Creative Fluency	4,760	2,934	0,876***
	Creative Flexibility	3,320	1,600	0,918**
	Creative Quotient	4,045	2,047	0,914**

Note: * p<0,1 ** p<0,5 *** p<0,01

Descriptive statistics & Shapiro-Wilk test of normality (age 36-45).

Cluster	Variable	M	SD	Test stat
Healthcare professionals	TEQ Score	45,140	5,398	0,850
	Feedback Seekers	5,857	1,864	0,715***
	Integrative Thinking	5,571	1,133	0,887
	Optimism	5,000	1,528	0,750**
	Experimentalism	3,000	0,577	0,777**
	Collaboration	6,571	1,134	0,887
	DT Traits Score	26,000	4,041	0,932
	Creative Fluency	4,000	1,291	0,760**
	Creative Flexibility	3,290	1,496	0,935
	Creative Quotient	3,677	1,361	0,913

Note: * p<0,1 ** p<0,5 *** p<0,01

Descriptive statistics & Shapiro-Wilk test of normality (age > 45).

Cluster	Variable	M	SD	Test stat
Age > 45	TEQ Score	46,000	5,865	0,857
	Feedback Seekers	6,000	1,414	0,982
	Integrative Thinking	6,167	1,472	0,958
	Optimism	5,833	1,602	0,908
	Experimentalism	3,333	0,817	0,822*
	Collaboration	6,500	1,049	0,960
	DT Traits Score	27,833	2,858	0,824*
	Creative Fluency	4,830	1,722	0,866
	Creative Flexibility	3,670	1,751	0,974
	Creative Quotient	4,193	1,749	0,977

Note: * p<0,1 ** p<0,5 *** p<0,01

APPENDIX F. – Normality test for tolerance to harmful habits sorted by background

Descriptive statistics & normality test (healthcare professionals)

Cluster	Variable	Mean	Std Dev	Test stat
Healthcare professionals	tolerance to smoking habits	3,080	0,967	0,818***
	tolerance to harmful alcohol consumption	2,000	0,956	0,908***
	tolerance to harmful eating habits	2,080	0,874	0,889***

Note: * p<0,1 ** p<0,5 *** p<0,01

Descriptive statistics & normality test (design students)

Cluster	Variable	Mean	Std Dev	Test stat
Design students	tolerance to smoking habits	2,670	1,171	0,879***
	tolerance to harmful alcohol consumption	1,780	1,072	0,869***
	tolerance to harmful eating habits	2,310	1,091	0,915***

Note: * p<0,1 ** p<0,5 *** p<0,01